

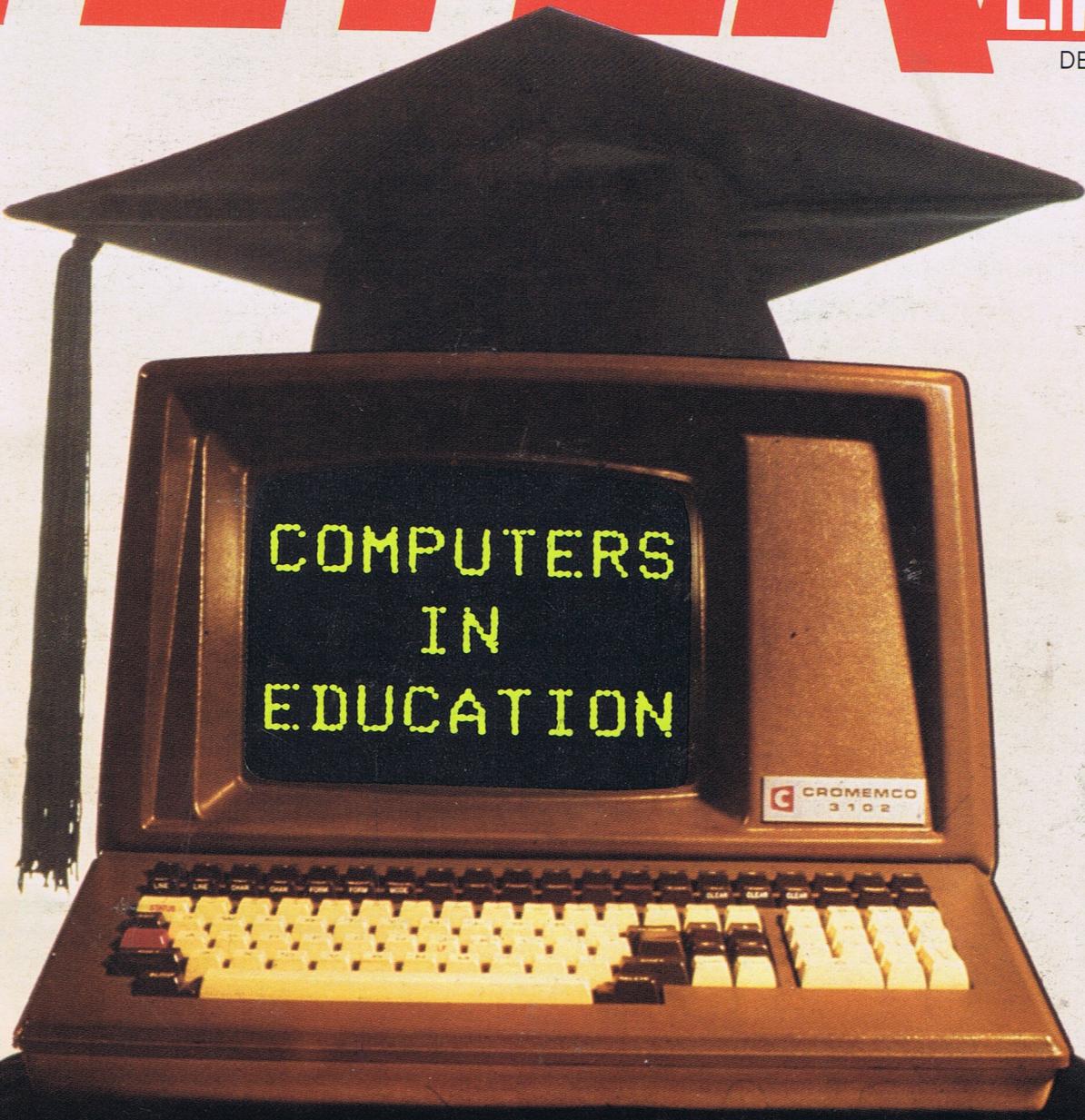
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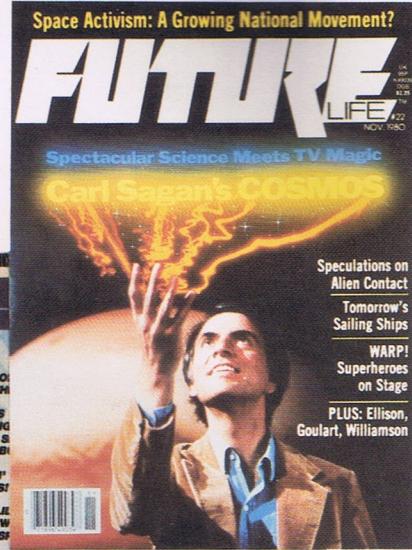
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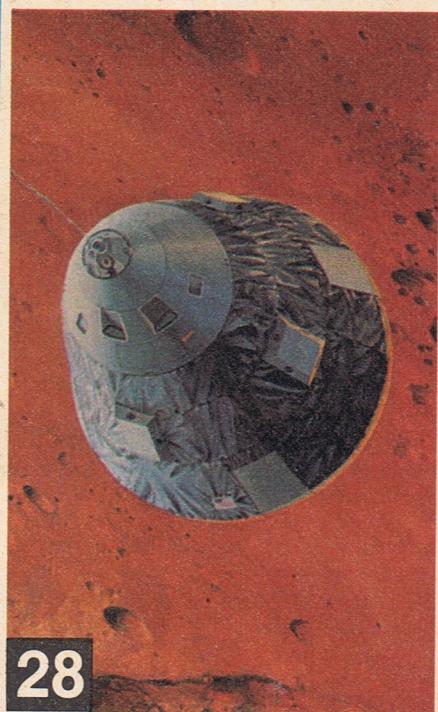
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#31 December 1981



28

DEPARTMENTS

4 OUTPUT/Kerry O'Quinn. A message from the Publisher.

6 INPUT/Creation reaction. Letters from our readers.

9 DATABANK/Quick cars and slow cigarettes.

20 SOUNDSCAPES/Lou Stathis. Kraftwerk: evolutionary agents.

34 IN PRINT/Bob Mecoy. Book news and reviews.

37 GALLERY/Frank Thomas' geometric life images.

48 AN EDGE IN MY VOICE/Harlan Ellison. Mundanes at the movies.

55 EARTH CONTROL/Bob Woods. Pork barrels — part 2.

58 PORTFOLIO/Bob Woods. Wayne Barlowe's alien art.

70 TOMORROW/Ronald J. Green & Clyde R. Jones. Tools of war.

FEATURES

14 COMPUTERS IN EDUCATION/Bob Woods. Today's schools are teaching tomorrow's leaders how to be computer literate.

22 INFORMATION NETWORKS/Willard Van De Bogart. How is humanity coping with the vast amount of data being produced?

28 THE CASE FOR MARS/Stan Kent. Last spring, scientists met in order to determine our next move to the red planet.

40 INTERVIEW: JAMES BEGGS/Trudy E. Bell. The new NASA administrator reveals his plans in an exclusive interview.

45 BLADE RUNNER — A RETRO-DECO FUTURE/Barbara Krasnoff. Syd Mead's impressions of the coming cityscape.

64 J. ROBERT OPPENHEIMER/Barbara Krasnoff. The story of the man who first created the bomb, then tried to stop it.



58

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ON THE COVER: Ready or not, the Computer Revolution is upon us, and nowhere is this more evident than in the classroom. Soon, computing will become the fourth "R" in education. For more details, see the article beginning on page 14. Cover photography © 1981 Michael Sullivan. Special thanks to Computer Centers, Digibyte Systems Corp. (New York); and Cindy Levine.

output

The Power of Paint . . .

Usually, this magazine is dedicated to a celebration of science—to the brilliant, daring men and women who explore the mysteries of nature and make discoveries that business, technology and industry then turn into things that yield benefits to our lives.

Yes, FUTURE LIFE is directed upward toward the stars—downward through the oceans and into Earth's core—and outward to all the lands and peoples of our planet. FUTURE LIFE is aimed in whatever directions the bloodless battles between the human mind and the laws of reality require.

Usually.

But there is another equally important aspect of this magazine and another equally important group of people to whom FUTURE LIFE is dedicated: artists.

Our Premiere Issue featured a portfolio of paintings by Chesley Bonestell, the grand master of astronomical art. It was Bonestell, with his book illustrations and magazine covers, who showed us what we might find when we landed on the Moon, and on Mars, and on all the planets of our solar system, and as far into the vast reaches of space as awareness could take us. He also showed us the vehicles and methods of getting there, and he made us impatient beyond endurance.

It was Bonestell's art and design work in science fiction movies of the '50s (such as *War of the Worlds*, *Destination Moon* and *Conquest of Space*) that added the impact of reality and the tingle of curiosity to our growing knowledge of space.

When later investigations showed some of his visions to be inaccurate, it did not alter his importance. There is a good chance that we would never have reached out into space as quickly nor with as much romantic enthusiasm without his visualizations to motivate us.

But that is the function of *all* artists: to show us what we cannot see in our day-to-day lives—to show us *beyond the ordinary*—to urge us toward new frontiers.

Artists, when they are excellent, are inspirational! That is why FUTURE LIFE devotes two features in each issue to artistic visions: Portfolio, our in-depth artist interview, and Gallery, our center spread framable display.

To us these features are as important as our articles on medicine, entertainment, physics, architecture, robotics, space exploration, electronics and all the other subjects of science.

In the past almost-four years you've seen full-color art by the top professionals of the world; people like Bob McCall, whose new postage stamp designs commemorating the Shuttle Era are as overwhelming as his giant mural in the lobby of the Smithsonian Air and Space Museum in Washington. You've seen hundreds of paintings by John Berkey, David Egge, Don Davis, Chris Foss, Jack Olson, Geoffrey Chandler, Denise Watt-Geiger, Don Dixon, Barclay Shaw, Shusei Nagaoka, Syd Mead, David Hardy, The Brothers Hildebrandt, Boris, Adolf Shaller, Vincent DiFate, Ludek Pesek, Andre Sokolov and our staff advisor for space art, Ron Miller. The full list is much longer, and it includes virtually every name in the neighboring fields of space art, science fiction and fantasy painting.

FUTURE LIFE is *not* an art magazine. Our main emphasis remains science and technology, but without the artists of the world—reaching beyond today with their imaginations—pointing the way—I truly believe that much of the work in laboratories and research centers would not come about so quickly.

Of course, it's hard to trace exact lines between beautiful paintings and new medicines, for instance, but one thing is certain and obvious to every reader of this magazine: extraordinary visions fuel our spirits and fire up the human soul with hope and inspiration. Artists provide that intangible power that propels the human race forward—toward a more wonderful future.

To them . . . cheers!

Kerry O'Quinn/Publisher

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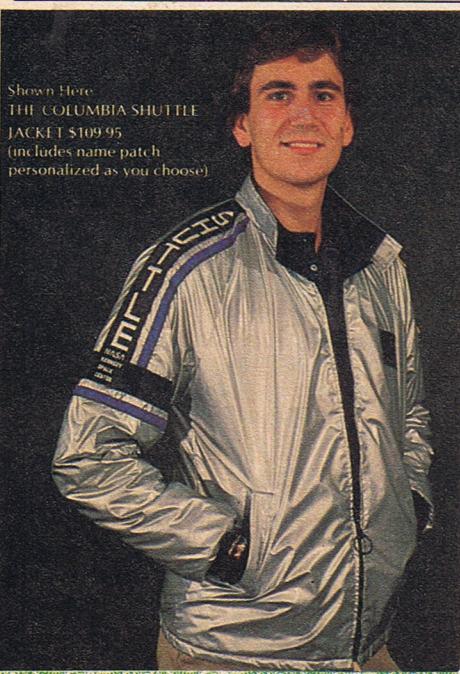
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CREATION CRITICS

... I see your June '81 issue tackles the endless evolutionism-vs.-creationism argument (Harlan Ellison, "An Edge in My Voice," FUTURE LIFE #27). In my area a hassle was recently raised about teaching creationism or the Darwinian theory in the schools. This surprised me because the Pacific Northwest is not a sort of Bible-belt area. At the same time, *Time* magazine reported increasing pressure on teachers and publishers in the States to lay off with Darwinian theory. Unreasonable behavior like this disturbs me, as a Christian.

I don't think the debate has been stirred up again because more people suddenly believe Genesis instead of the textbooks. It is easier to believe that some political or economic reasons lie behind the rise of the Moral Majority, and they (and others) find that stirring up fruitless arguments puts them in the news, whether or not they influence our educators. Some Bible-belters manage to shove their beliefs down the throats of others; they are also effectively blacklisting scientists and publishers who won't bow to pressure. None of this has anything to do with Christianity.

As for the debate—we aren't going to settle it until the prime Witness chooses to testify. I propose that we either wait for Him, or form a group to ask Him to settle the debate.

Garth Spencer
Victoria, B.C., Canada

... I was impressed by the series of letters in Harlan Ellison's column (FUTURE LIFE #27) regarding creationism. I'm always glad to hear voices raised in favor of reason. It seemed to me, however, that all parties involved in this debate were leaning a bit too far toward the emotional, and perhaps this caused their objectivity to slip. Perhaps not. Also, I wonder if Mr. Ellison isn't spending his energy on converting those already faithful to the evolutionary cause, instead of speaking to those who might profit more by these arguments, namely people who are undecided on the evolution/creationism conflict, or even somewhat opposed to the theory of evolution. Mr. Ellison's force and eloquence are greatly appreciated by those readers who already believe as he does (myself included), but I can't help wishing he could reach a less sympathetic audience, if only to give them a view from the other side. As for finding sponsors "beyond the vengeance of the Moral Majority," I believe (and hope) that they are more common than he expects.

I was curious about his inclusion of Cotton Mather among the list of offenders against freedom of speech. Mather did, of course, repent of his stand against witchcraft and was an influential force in ending the trials. Does Mr. Ellison, then, feel that there is hope for the creationists?

Joanne McLain
Denver, CO

... I don't understand why creationists feel they need equal time. Haven't they had enough time already? If they haven't convinced everybody in over 4,000 years, they can hardly begrudge the modest decades which science has had to counter their argument.

And where are the facts to support their theory? They seem to delight in shooting holes in the opposition, then sitting back and expecting us to take them at face value. At least anthropology offers fossil records, solid bones which have been carbon dated... tons of facts to support evolutionary theory. Creationists offer us that irrefutable evidence—the Bible. Well, I'm sorry, but the time has passed when simply quoting hearsay settles an issue.

Creationists don't want equal time. They want to monopolize it. I don't hear any preachers talking about Australopithecus from the pulpit. If creationists really want to show their sense of fair play, let's put another chapter in the Bible—after Genesis is okay—which reads "In the beginning Darwin proposed...."

Al Coco
New York, NY

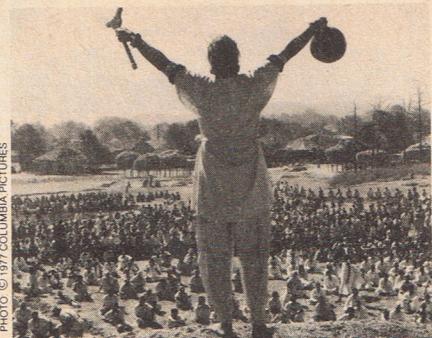
... Glorious congratulations to FUTURE LIFE #29 for Barbara Krasnoff's excellent, surprisingly even-handed report on the creationist movement. It served as a sober, civil and reasonable balance against the ignorant, alarmist columns on the subject... The article restores my faith in the magazine, which has heretofore often seemed to veer off into a shrill, shallow rancor, attacking any ideology or institution that did not fit into its own futuristic schemes. But you're back on track now.

John Clifton
St. Albans, NY

IN THE MAJORITY

... Through the advent of Jerry Falwell and his "pristine-pure" Moral Majority, your magazine and what it stands for has become an endangered species. These so-called "I Love America" Fundamentalists have essentially declared themselves a religious-political faction dedicated to hacking down the very things that you and I believe in: free enterprise, individual liberty and scientific progress. The separation of the church and state is a thing of the past; the Moral Majority has dictatorially taken that right from the Ameri-

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can public.

I cannot begin to express my feelings of utter despair and loss as I was reading Harlan Ellison's editorials against the Moral Majority. Harlan's articles conveyed that these people are willing to sacrifice all human logic and scientific basis for a "god" that will return at some undetermined date. Hal Lindsey says, "Soon," but that is what was said 2,000 years ago, and for all they know, they could be saying that another couple of millenia from now.

These people are trying, with their creationist science and moral views, to bring a total collapse of logic and free society. Without free enterprise, without the individual liberty to think and say as we please, and without scientific progress towards a better understanding of the natural wonders in our universe, our society will take a deep plunge into the dark ages of chaos where justice is only a memory and superstition reigns freely over the Earth.

I will say this plainly: I don't want that to happen. This is the biggest single issue of our time. It effects everything and everyone around us. As long as there are Harlan Ellisons and Norman Lears in the world, there is hope.

In FUTURE LIFE #29, I noticed that you neglected to print the "Editor's Note" of Mr. Ellison's "free hand to express his opinions." Mistake or not, I applaud FUTURE LIFE's definite stance against the Moral Majority.

Kenneth T. Goodpaster
Lincoln City, OR

... The Moral Majority, KKK and Fundamentalism all have one thing in common, ignorance!

It is among the eternal plagues of mankind. I am very fearful of the rise of the KKK, Nazism and Evangelism. It is vitally important to keep all these manifestations of ignorance in check. Man's only progression is through science, but it is always the weak-minded masses that need something set before them to follow.

I make a plea to the individuals who can actually think for themselves. Don't allow these things to slip by. It is a good thing that we are continually reminded about the Holocaust. (I hear that some German schools are trying to ban *Mein Kampf*—a good way to make them forget.)

It is another good thing that we can read books by Kurt Vonnegut, Harlan Ellison and Sinclair Lewis. At least they still don't burn the books in my city.

William Winans
Cleveland Hts, OH

THE WRONG RING

... Re: "Sky Angle," the letter from Mitchel Allen pointing out the "error" in my painting of Uranus in FUTURE LIFE #27... What he heard about Uranus and its rings obviously referred to their *present* orientation to Earth and the sun. Since one of Uranus' poles is now more or less facing the sun, the lighting and shadows shown in my painting are impossible—at the present time. However, Uranus' axis always points in the same direction, relative to the stars, so that the orientation of the planet to the sun is always changing. In about 20 years or so the rings will be in the same plane as the sun—the situation shown in the painting.

Ron Miller
Fredericksburg, VA

SPACE FANS

... As a worker at the Kennedy Space Center for the past seven years, I have seen the center in its post-Apollo days, which we are still in. I have witnessed the Viking and Voyager launches, and have taken pride in seeing their results. It is sad to see the space program winding down in its exploration program. There are no new Vikings or Voyagers planned for the future. Our only chance to rendezvous with Halley's Comet for the next 76 years has been shelved. Even the number of the space shuttle launches have been cut back.

There are many pro-space groups who are launching public letter writing campaigns to present to Washington a mandate that the taxpayers of America want a healthy space program. The need for a more unified front

by these organizations is great. The famous line "United we stand, divided we fall" applies greatly to the future of space.

James B. Harris, Jr.
Director
Florida Spaceweek Committee
Cocoa, FL

... I am a strong believer in the pro-space movement of this great nation. I have written to the leadership of this nation and at the present moment these leaders do not take the space movement seriously.

I would hope that the Administration would wake up and review the budget for NASA's programs before the next election. If not, perhaps we can remove these anti-space forces and place some of our activists in their place.

I would like to suggest that some one or organization create a National Space Political Action Committee which would be made up of all space organizations which would be a united effort for a better space program. I truly feel that the space movement could become the movement of the 1980s.

As for me and a few associates, we plan to create a pro-space business. The only thing we will lack will be investors. I know that it is up to the pro-space activists to get into business and to create special lobbies before Congress will listen.

I would like to praise your outstanding magazine FUTURE LIFE for making me aware of the future. I would like to encourage you to keep up the good work.

Larry Richard Cate
APO NY

SATURN SIGHTS

... Having viewed the great pictures of Voyager II's flyby of Saturn a couple of days ago, my eagerness to own a large photo of the ringed planet is even stronger. The color photo taken by Voyager I has been shown on television

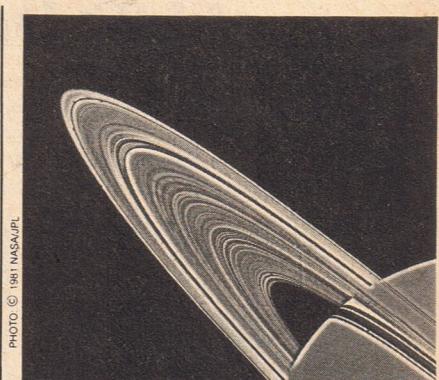


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many times and in a large number of magazines, one of them being yours.

In FUTURE LIFE #25, on page 15, you have a truly beautiful picture of the planet along with an inset of the front cover of a 1939 *As-tounding* magazine. Where might I be able to secure a large copy of the photo (not the inset)?

D.M. Cunningham
Fort Worth, TX

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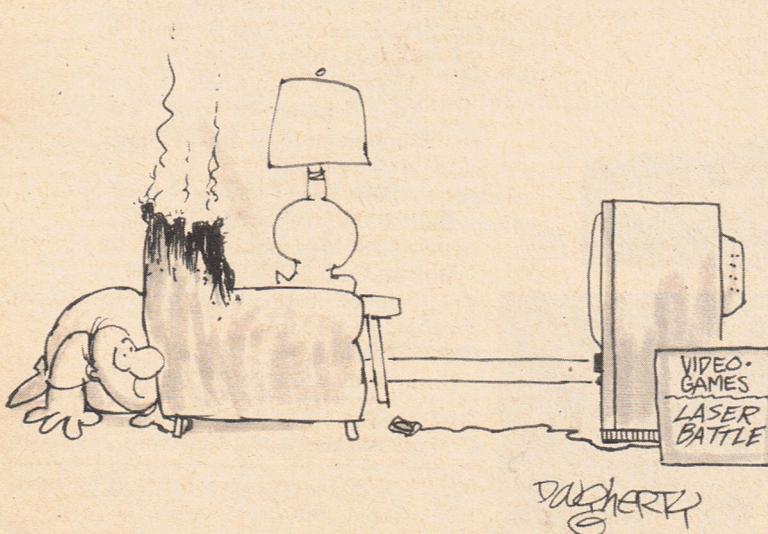
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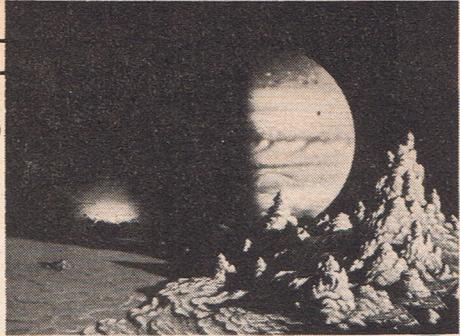
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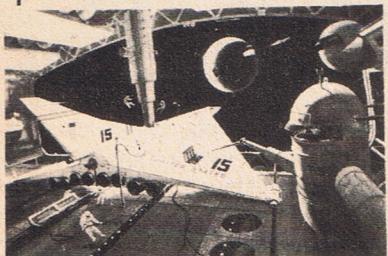
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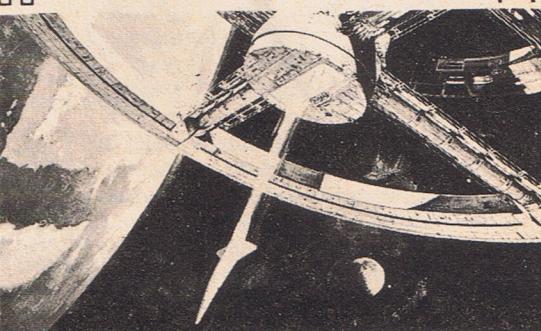
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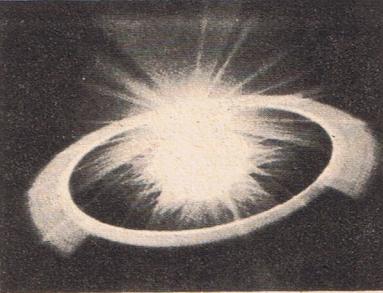
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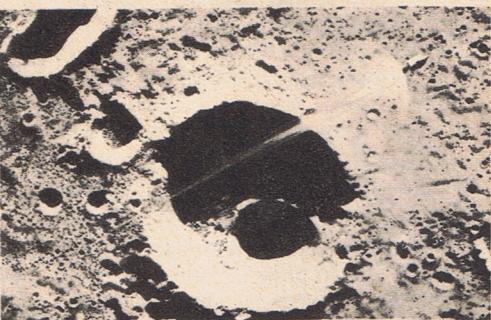
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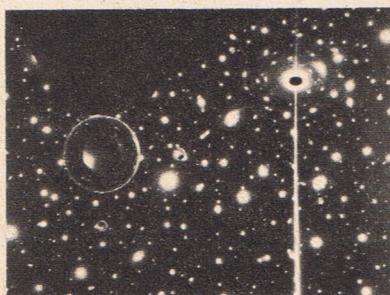
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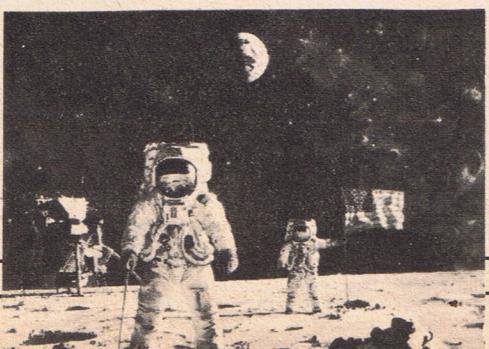
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NU YU REVU

The nature of the future being what it is (or will be), we regularly get some rather weird mail around the FUTURE LIFE offices. Most of it is immediately cast into our circular file (otherwise known as the trash can); some of it is passed from desk to desk to provide a moment or two of humor. However, a couple of weeks ago we received a real winner. It's the premiere issue of *Nu Yu: The Fine Art of Vivisection*, a send-up pointed at the mutant world of bioengineering.

The accompanying news release read: "Much has been written about how recombinant DNA will provide us with a variety of new services and products . . . Such rapid technological advances usually have unforeseen consequences, making it hard for the style conscious to keep in step. How will fashion designers react when living fabrics become available? Is Recombo Deco in your living room's future? Find out in *Nu Yu*, the magazine that asks: After the Industrio-genetic Revolution, what will the 'New You' be like?"

The 24-page lampoon, published by Data Day Communications of Philadelphia, is actually dated "Summer 1997." Writer Daniel Silk and illustrator Julian Kernes document the words and images of avant garde gene sculptor Jolette Kohn, described as be-

Now you too can pretend you're the cream of Victorian society with your very own
ELEPHANT MAN

Why buy just any freak when you can own the
Most Famous Freak of All?

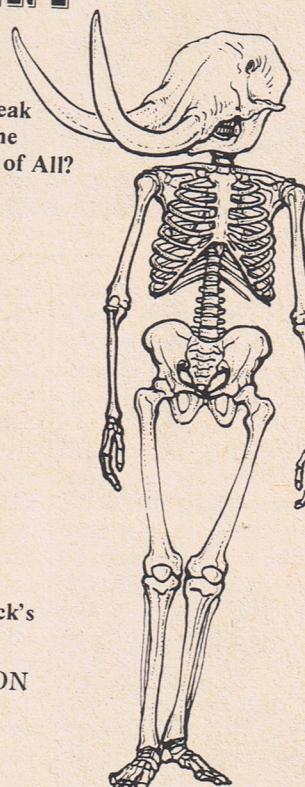
GUARANTEED to speak perfect Victorian English.

GUARANTEED to be witty, philosophic, yet pathetic.

GUARANTEED HOUSEBROKEN Won't embarrass you in front of guests.

GUARANTEED AUTHENTIC Cloned with cells taken from John Merrick's own skeleton.

LIMITED EDITION Each one signed and numbered by the artist.



BARNUM & SOTHEBY, Ltd.

ing "at the forefront of those who utilize life itself as a medium of personal expression." Kohn's genetic designs include such biological feats as the Gypsy Table, a

living furniture freak that serves drinks or doubles as a children's toy; the Sonic Boomerang, a shrieking combat and crowd-control weapon originally devised

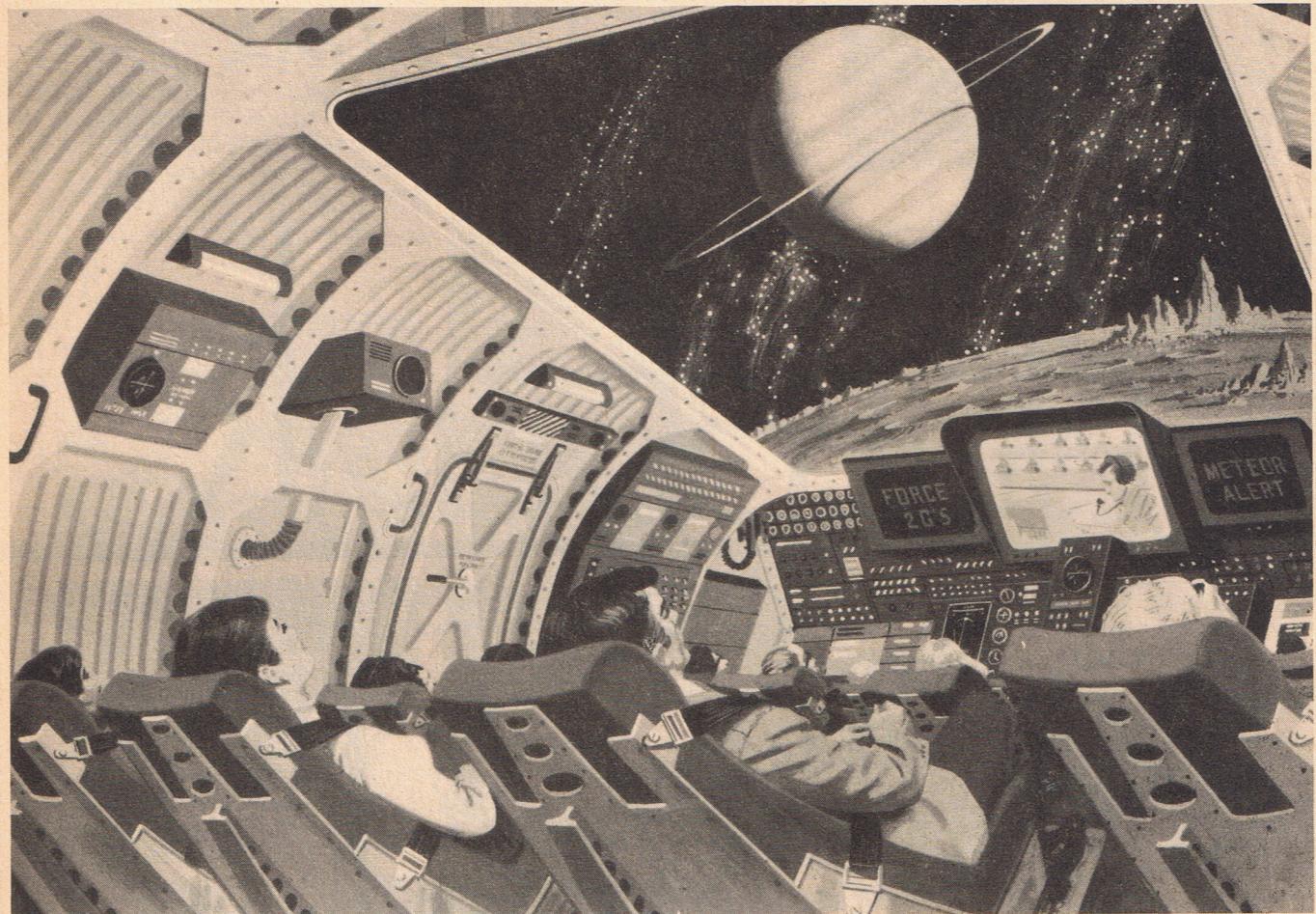
as a musical instrument; and Karton O'Klowns, egg-shaped joke-telling organisms created from the DNA of long-dead comics.

Nu Yu visits the Synthetic Mutations Auction, where bidders and speculators, "representing native life forms from many planets," assemble to buy such live oddities as a unicephaloid bivertebrate and a gargantuan mammary gland, entitled "The Playboy Philosophy," which went for a whopping \$880,000.

Aside from the item reproduced here, another personal favorite in our office was the "Alien Klown," modeled after the gruesome creature designed by surrealist H.R. Giger for the movie *ALIEN*. Closely resembling the original—except for the addition of Bozo nose, hands and feet—it's touted as "The perfect babysitter! Entertains Darlings, disciplines brats." Described as easy to feed, totally omnivorous and a great garbage disposal, the versatile invention even sings and tapdances. To demonstrate their consumer awareness, the advertisers, after bragging that their product "even hangs by its tail," parenthetically warn that, "If head cover comes off when he hangs by his tail, his little plastic brains fall out."

Though subscriptions to *Nu Yu* are not available, single copies of the first issue can be purchased by sending \$2 to Data Day Communications, Box 251, Philadelphia, PA 19105.

—Bob Woods



ART: TRANS-LUX MULTIMEDIA CORP

This "spacecraft," now in construction, will be the highlight of the 75-minute SF theatrical attraction "Space Works."

ENTERTAINMENT

IN THE WORKS

Okay, so you *don't* have that doctorate necessary to qualify for the shuttle program. Who cares! There's another way to get to the stars—or, at least, a way to *feel* as if you've gotten there.

The Trans-Lux Corporation, the company that owns and operates the highly successful "New York Experience" multimedia show, is now developing a new theatrical attraction called "The

Space Works." Focusing on interplanetary flight, the show will attempt to give audiences a realistic, multi-sensory taste of the possibilities of outer space travel circa 2010.

Visitors to "The Space Works" will begin by stepping into an environmental theater designed to resemble a spaceport. They will be able to try their suitability as astronauts in a hands-on pre-flight laboratory (with, one assumes, very little chance of "failing") and compare their

scores to those of real astronauts. There will also be a variety of exhibits and such "space" refreshments as ice cream in squeeze tubes.

But the highlight of the attraction will be its spacecraft theater, in which visitors will be able to take a science fictional journey into space. The Trans-Lux people have designed an oversized version of the flight simulators used to train astronauts; and this, along with a variety of film and sound effects, will give audiences

a vivid impression of having participated in an actual space flight. In addition, the show will include a human centrifuge with pod-like vertical couches meant to simulate conditions of an accelerating and orbiting rocket.

Designed for heavily populated urban areas, "The Space Works" continuous show is expected to last for about one and a quarter hours with a flow-through rate of 380 persons. A New York premiere is targeted for late 1982. —Barbara Krasnoff

REAL ESTATE

A PIECE OF THE ROCK

Upset by real estate prices here on Earth? You can get a fresh start on another world by "purchasing" land on Mercury.

The Astronomical Society of the Pacific (a nonprofit scientific organization) is offering "deeds" for land on Mercury as a way of soliciting donations to support its educational activities. (All such

donations to the Society are completely tax-deductible.) A nice recreational site with a minimum of 14,000 acres is only \$25. A 56,000-acre homesite (with crater) is \$50, and a spectacular estate of 126,000 acres can be yours for only \$75.

The low tax base, liberal zoning laws and pollution-free (also atmosphere-free) environment make these sites an ideal place to get away from it all. However,

prospective buyers should be warned that temperatures on Mercury can rise to about 700 degrees Fahrenheit (370 degrees Celsius)—hot enough to melt lead and to broil unprotected real estate speculators.

"Deeds" can be made out in the purchaser's name or in any name which is specified. Each grantee will receive a handsome quitclaim deed and a high-resolution Mariner spacecraft photo-

graph identifying the land area purchased, both documents suitable for framing. A brief summary of conditions on Mercury and a table of current information about the entire solar system are also included.

For more information about this interesting real estate deal, write the Astronomical Society of the Pacific, Mercury Deed Department, 1290-24th Ave., San Francisco, CA 94122.

WHAT A DRAG!

CD = MPG

During the next decade your automobile's CD rating may become as important as its MPG (miles per gallon) figure. The CD (coefficient of drag) is a measure of how easily your car slips through the air. The lower the drag, the less power needed to maintain any speed, and less power translates to more miles per gallon.

Aerodynamics have become increasingly more critical in the design of the modern-day passenger car because of the emphasis on fuel economy. European manufacturers like VW, Mercedes and Citroen have tested their designs in

wind tunnels for some time for both fuel efficiency and high-speed stability. Now General Motors has completed construction on the first full-scale wind tunnel in the United States at their Detroit Tech Center and Ford hopes to finish their aerodynamic research facility within the next two years.

Ford's experiments at the Lockheed low-speed wind tunnel in Marietta, Georgia, have resulted in an almost one MPG increase in their CAFE (corporate average fuel economy) number. To have achieved the fuel efficiency rating by redesigning to smaller vehicles would have cost 50 times their \$5 million investment.

GM recently unveiled the *Aero*

X, an experimental model of a full-sized four-passenger automobile, designed with the knowledge gleaned from their wind tunnel testing. This advanced vehicle features recessed windshield wipers, retractable headlights, and flush door glass and wheel covers to give the body a clean aerodynamic shape. The *Aero X*'s CD is a sleek .285, while the average compact sedan has a CD of .460. The new EXP from Ford sports the lowest rating of any production car on today's market with a .370.

Don't expect to see the *Aero X* or other radical designs at your local dealerships for a while, but by the end of this decade the wedge-shaped prototypes may start rolling off Detroit's assembly

lines.

The shape of the future is an odd one indeed if the experimental car of Italian auto designer Pininfarina is any indication. Looking like a banana on wheels, it's one of the sleekest entries in the aerodynamics race with a drag coefficient of only .161. While the Pininfarina "banana car" is now only an exercise in styling, when it is redesigned as a usable family sedan it would still cut through the air with an impressive .201 CD.

In the years ahead, we can expect to see automobiles take on a more wedge-shaped silhouette, with low hoods, raked-back windshields and high rear decks, a shape long favored for racing cars.

—Christina Westcott



Bernadette Peters as a lonesome robot in *Heartbeeps*.

FILM

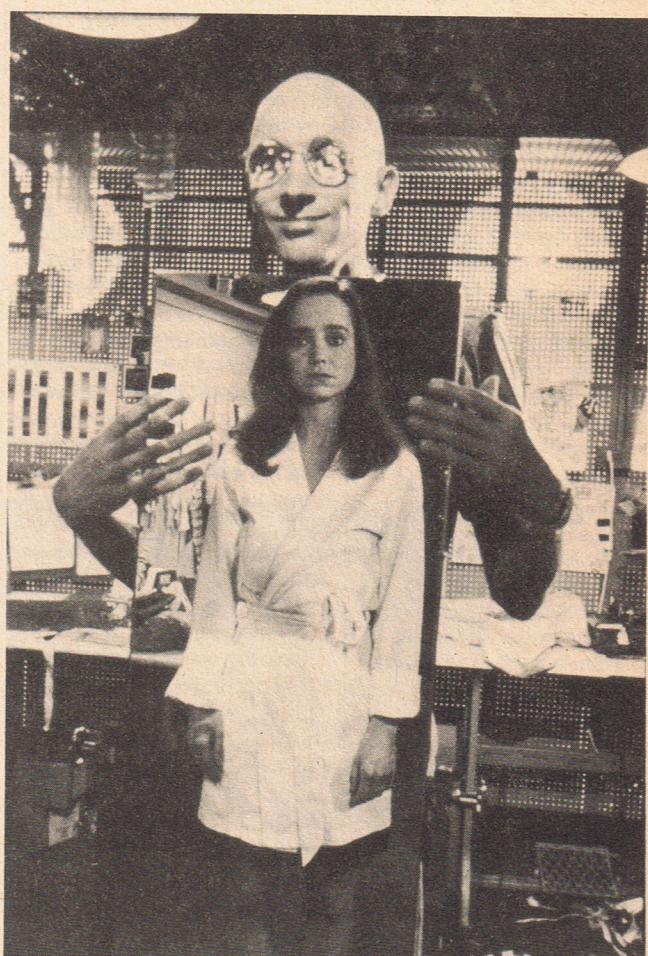
FREAKY FUTURES

While sophisticated adult comedies such as *Manhattan* and *California Suite* have proved successful box-office draws, there's nothing like a truly weird movie to bring in the bucks. Two members of that species will be making their debut in the latter half of 1981: *Shock Treatment* and *Heartbeeps*.

Shock Treatment, a send-off of today's TV-crazed culture, is being brought to you courtesy of the same folks who came up with

the bizarre *Rocky Horror Picture Show*. The film stars Jessica Harper and Cliff De Young as Janet and Brad Majors, a typical middle class duo who find themselves in the small town of Denton, U.S.A., where reality is television and television is reality. Besides coping with a bevy of insane psychiatrists, tap dancing nurses and marriage counselling M.C.'s, the confused couple must defeat the slimy Farley Flavors (also played by De Young), an evil fast food tycoon.

Meanwhile, in the year 1995, a



What will mad psychiatrist Cosmos McKinley do with poor Janet?

different type of couple is having problems. *Heartbeeps*, due in the theaters this Christmas, presents the tender love story of two household robots, played by Andy Kaufman and Bernadette Peters, who decide to build a

baby. Filmed on location in Santa Cruz, California, the film also stars Randy Quaid, Kenneth McMillan, Christopher Guest, Melanie Mayron and "three mechanical robots."

—Barbara Krasnoff

HOT TIPS

SLOW BURN

Know someone who smokes in bed? The tip of the average cigarette burns white-hot at 900 degrees centigrade. Drop it, and in two or three minutes a cotton bedsheet will go up in flames.

But Charles Cohn, a 79-year-old Atlantic City, New Jersey, inventor with six cigarette-related patents to his name, has come up with a cigarette that refuses to ignite the bed linen.

Cohn's solution: Treat the cigarette paper with sodium silicate. The sodium silicate, a well tested non-carcinogenic chemical, when applied wet to normal cigarette paper, dries to leave a thin film that holds in the heat. With Cohn's treatment, a standard cigarette's 900-degree tip temperature plummets to 600 degrees. And though that may still sound high, the difference in temperature is enough to keep cotton batting from fully igniting.

Cohn's cigarette is also self-extinguishing—and it goes out in less than three minutes if it isn't puffed on, as opposed to normal cigarettes, which often burn for their entire length if left unpuffed.

Cigarette industry executives have been strangely lukewarm in response to Cohn's cool-tipped

idea. Some call his cigarette a nuisance and a health hazard, saying that it delivers far more tar and nicotine, while others worry that customers will balk at a product that goes out in their hands. Some have even spread the tale that a relit cigarette doesn't taste as good.

Cohn is angered at what he sees as a repetition of false rumors.

"The only thing of mine that they tested was an old patent from 1972. Frankly," he says, "I can't figure them out. I don't know why they haven't picked it up." His frustration is evident as he touts his invention's potential advantages.

"They give off hardly any smoke between puffs, and if you had them, the laws that now exist against smoking in public places wouldn't be necessary." A National Cancer Institute study also showed that while his treatment gave more puffs per cigarette, there was actually less tar and nicotine per puff.

But frustration may soon give way to self-satisfied vindication. Cohn's ideas seem to have gotten through to some after all. He confides that he "is now in the process of negotiating with those in the industry." But with who? "That I can't tell you," he says.

—Dave Fleischer

AWARDS

HUGO HONORS

Well, another year has come and gone, and once more the world's science fiction fans (or at least those who could afford to shell out the money for a convention membership) have voted on what they consider to be the best SF of the year. The 1980



Award winner Joan Vinge.

PHOTO © 1981 FREFF

Hugo Awards (named after the legendary editor Hugo Gernsback) were given out during the 39th World Science Fiction Convention in Denver, Colorado, on Sunday, September 6. The winners include:

Best Novel—*The Snow Queen* by Joan Vinge. Best Novella—"Lost Dorsai" by Gordon R. Dickson. Best Novelette—"The Cloak and the Staff" by Gordon R. Dickson. Best Short Story—"Grotto of the Dancing Deer" by Clifford D. Simak. Best Nonfiction Book—*Cosmos* by Carl Sagan. Best Professional Editor—Edward L. Ferman, editor of *Fantasy & Science Fiction* (who also won a special award for his contribution to the field). Best Professional Artist—Michael Whelan. Best Dramatic Presentation—*The Empire Strikes Back*. The John W. Campbell Award for best new writer was won by Somtow Sucharitkul.

—Barbara Krasnoff

SPACE

HIGH SOCIETY

The letter begins: "Dear Fellow Inhabitant of Earth:" Someone asking for another handout, right? Wrong. This time it's a little different. The Planetary Society is trying to drum up active support for the space program, both here and abroad.

In less than a year, the Society has signed up over 40,000 members and the non-profit organization is gaining strength in not only numbers, but in actual lobbying strength. Society president Carl Sagan has assembled an impressive board of advisors made up of a cross section of people from the scientific, entertainment and political worlds.

The advisors include Isaac Asimov, James Van Allen (discoverer of the Van Allen Radiation Belt), Johnny Carson, Harrison Schmitt (former astronaut and current Senator from New Mexico), Shirley Hufstedler (former secretary of education), Paul Newman and Bruce Murray (di-

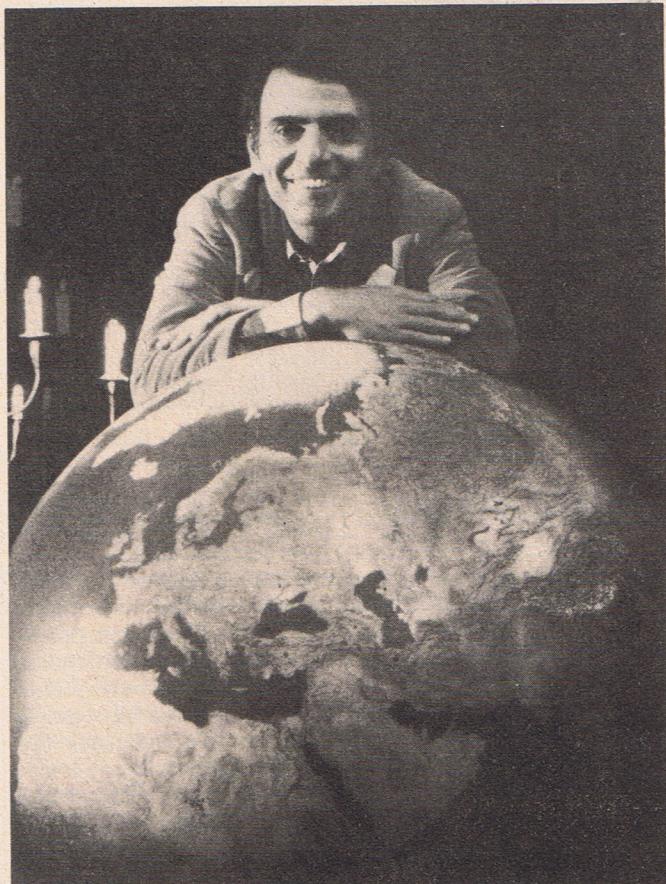
rector of the Jet Propulsion Laboratory) among others.

The whole idea is to keep Congress and the White House aware of renewed efforts to get Earthlings back into space. To do so, the Society is planning numerous events to get the general public to turn their eyes spaceward. Currently touring the country is "Voyager on Tour," a lecture series discussing why the Voyager satellite is in space and what we can hope to learn from the realms of information it has already provided.

For a \$15 fee, members of the Society receive a bi-monthly newsletter filled with space science articles, a report on developments in Washington and a calendar of related events around the country. They also receive the obligatory membership card and certificate. And the society will also be sending out special mailings asking for specific help on lobbying efforts.

For more information, write Planetary Society at P.O. Box 3599, Pasadena, CA 91103.

—Bob Greenberger



Television personality Carl Sagan, president of the Planetary Society.

PHOTO © 1981 PBS

CONFERENCES

TECH TALK



A robot conference in the offing.

Well, fall is here and the annual migration of scientists to their various conferences has begun. Any of our readers interested in observing this highly interesting phenomenon may wish to attend the following:

Venus enthusiasts will be hopping planes to a NASA international conference entitled "The Venus Environment," November 1-6 in Palo Alto, California. The conference is being co-chaired by NASA's Ames Research Center and the University of Arizona, and some 500 scientists from the U.S., U.S.S.R. and Europe are expected to attend. All known information about Venus will be disseminated in the course of the conference, including the latest photos taken by the Pioneer Venus Orbiter, which has been providing us with pictures of that planet regularly for more than two years. For more information on "The Venus Environment," contact the Ames Research Center, Moffett Field, CA 94035; (415) 965-5091.

For those in a more robotic frame of mind, the American Society for Cybernetics will be holding its first major conference since 1974 in Washington, D.C. The program will be held October 29 through November 1 at George Washington University's Marvin Center; and has as its theme the redefinition of the field of cybernetics. For more information, contact Dr. Laurence D. Richards, Dept. of Administrative Science, Colby College, Waterville, ME 14901; (207) 873-1131.

—Barbara Krasnow

SPACE BOTANY

FLYING FLORA

A population of dwarf sunflowers aboard the space shuttle *Columbia* may bring scientists one step closer to resolving a century-old controversy about how plants grow.

Since the 1800s, observers have known that plants usually move in an elliptical or circular pattern, weaving back and forth as they grow. Although these remarkable movements, called circumnutations, are exceedingly slow (one complete cycle takes 100 minutes), why they move as they do remains a baffling question. There are two schools of thought on the subject, according to Dr. Allan H. Brown, research biologist at the University of Pennsylvania. One view, held by Charles Darwin, an early observer of plant circumnutation, is that the motion develops from within, an innate behavior which somehow facilitates a plant's survival. A more popular view held by contemporary scientists is that the movement of plants is simply a consequence of the effect of gravity. One way to test the gravity theory is to shut it off, and the *Columbia*'s weightless environment makes that eminently possible.

Although the basic scientific controversy is scheduled to be resolved on Spacelab 1's 1983

mission, preliminary experiments with plants on the shuttle have already begun. The most recent test involved 85 sunflower seedlings (*Helianthus annus*) or the "Teddy Bear" variety, planted in glass-lined metallic pots and carried aboard the *Columbia* just hours before the launch at Cape Canaveral this fall. The experimental package was designed primarily to test the effect of varying the soil moisture content on the growth of the seedlings. Scientists suggest that it isn't necessarily true that the amount of moisture needed to support optimal plant growth in space will be the same as what is required for identical species grown in the same type soil on Earth. In orbit, the distribution and rate of movement of the soil moisture is likely to be influenced by weightlessness. The design of the later experiment with the seedlings on Spacelab 1 will depend upon what the researchers learn about appropriate soil moisture levels from this spaceflight.

In their earthbound laboratory at the University City Science Center in Philadelphia, Dr. Brown and his associate, Dr. David Chapman, have conducted many experiments on the effect of gravity on plants. Using equipment ranging from a tiny infrared camera to a 20-foot-diameter centrifuge, the resear-

chers have simulated weightlessness and produced forces of gravity extending up to 15 g's. According to the digitized information returned by the camera and analyzed by computer, the degree of plant movement depends upon the pull of gravity. Plant oscillation increases, report the scientists, from the simulated state of minimum gravity to one. This seems to confirm the theory that a gravity-sensing mechanism in plants coordinates the movement so they continue to grow upward. But not all the data is in accord. "There is absolutely nothing in the theory to predict that as you approach very low gravity in simulation experiments, the oscillation or plant-nodding speeds up. But that is exactly what we found," Dr. Brown says.

If the movement of plants is a response to gravity, the experiments in space should reveal something different. But if the motion continues in weightlessness, then Darwin was right and plant circumnutation is an innate characteristic. In either case, the experiment aboard the *Columbia* will help solve the dilemma. It will also enable us to learn something new about the mechanism of plant growth, essential information for space farmers of the future who will need to know more about how their gardens will grow.

—Lila Finck

Experiments are now in progress that will determine whether plants can thrive in space.

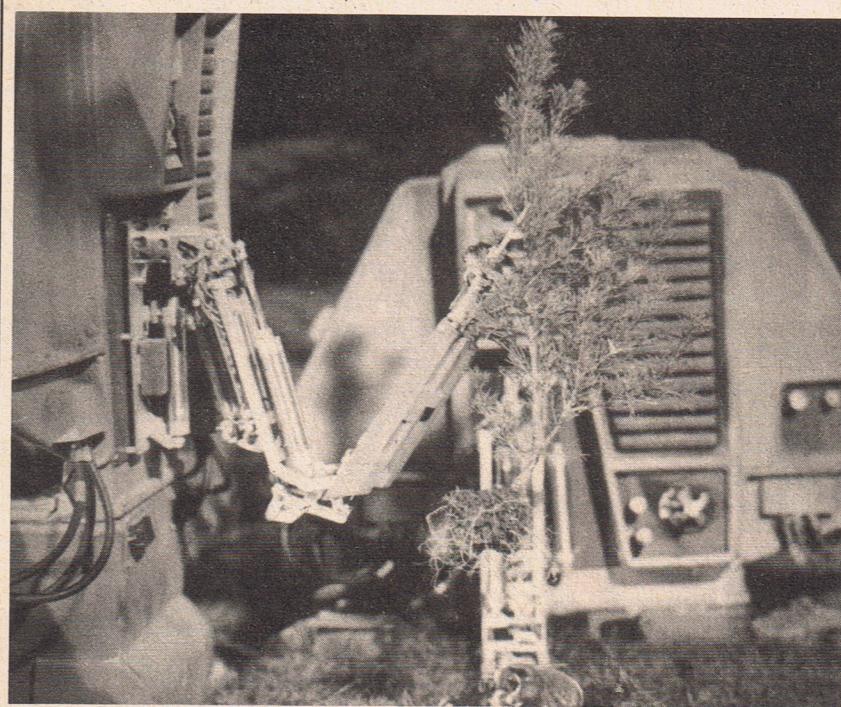


PHOTO © 1972 UNIVERSAL PICTURES

Computers in Education

The microcomputer is rapidly becoming the new darling of the education world. Its applications will change the way students learn, but not before some critical questions are answered.

By BOB WOODS

There's a revolution taking place in the classroom. It's different from past revolts. This is a quiet one, whose noisiest moments come from the hum of electrons zig-zagging across tiny silicon wafers; whose harshest language is Basic, or Pascal, or Logo. This revolution's effects, nonetheless, will rock the foundations of education like no other innovation in history has. No one is sure where it will lead, but the microcomputer is the tool that has thrust educators, parents, manufacturers and, most importantly, students into the threshold of this revolution.

There are several key factors that have triggered the recent widespread influx of microcomputers into America's schools.* Probably the single-most significant ingredient was the introduction, in 1975, of the microprocessor, the fingernail-size silicon chip that is the electronic heart of the small computer. This system, which can be a personal, home, desk-top or micro computer, is usually referred to as the "hardware." The microprocessor has not only shrunk the computer itself to roughly the size of a conventional television set, but has drastically reduced prices to the point where almost every school in the country can

afford at least one, even with the serious budget crises that many are experiencing lately.

The next integral factor is the "software," the programmed lifeblood of any computer, that has begun flowing from the major educational publishers as well as from a new cottage industry of homespun programmers. At the same time, a sweeping attitude change is occurring. Computer phobia—the fear that humans are doomed to future enslavement by intelligent machines—is being replaced by the recognition that, when properly integrated, computers will become an essential tool in everyday life. Teachers, parents and administrators number among this breed of new, if sometimes reluctant, believers. Today's students, on the other hand, have no problem with accepting computers in their classes. This comes as little surprise when you realize that most of them have been plugged into any number of electronic and video games and gadgets almost since birth.

Finally comes the all-American element that has inspired so many other changes—profit. Both the hardware and software producers understand that their products are now economically and technologically accessible, as well as pedagogically acceptable, to traditionally conservative customers like schools, so they are forging special market strategies to answer the call.

As with most innovations that affect a large portion of society, there is going to

be a period of adjustment, along with a series of philosophical and practical problems to be solved during that period. The inherent power of the computer itself, still far from being fully tapped, makes it radically different from other teaching aids; like the now-commonplace pocket calculator, or the much-touted multi-media teaching labs that went in and out of vogue during the '60s and early '70s. However, the computer is not fated to end up collecting dust on a shelf next to overhead projectors and slide trays—the micro is here to stay. Within the next decade, high school graduates without a working knowledge of computers will join the ranks of a new wave of illiterates. Instead of asking why he can't read, the question will be, "Why can't Johnny compute?"

Certainly, the use of computers in education is not entirely new. College students have utilized them for years in math and science courses, and computerized record-keeping is commonplace on campuses, though these employed large "mainframe" units and only later the smaller minicomputers. Grade schools started experimenting with computers as early as 1962, when Control Data Corp. introduced its time-sharing Plato system, which tied in-school terminals to large centralized computers over telephone lines. Skittish educators never really bought Plato—neither conceptually nor literally. It took the introduction of the microcomputer to get the ball rolling. Today there are a new breed

**This article will be confined to the situation in primary and secondary schools. Not that the microcomputer is any less significant on the college level, but the greatest, most far-reaching changes are taking place in the lower grades.*



of hardware manufacturers on the scene. Low-cost systems from Apple, Radio Shack, Commodore, Atari and Texas Instruments are the most popular, though big-name firms like Hewlett-Packard, IBM and Xerox are now introducing micros. Electronic hobbyists were the first buyers, but it was only a matter of time before micros found their way into the classroom. According to a recent report in *Business Week* maga-

zine, the school computer market—which delivered 70,000 units worth \$102 million last year—will grow 31 percent annually to 270,000 grossing \$350 within four years.

The hardware manufacturers offer a variety of packages; some include only the most basic components, others supply a wide range of accessories, software and support services. Generally speaking, a single microcomputer can be pur-

chased for less than \$1,000. But manufacturers are so eager to develop the market they are offering attractive discounts when a school orders more than one unit.

All these factors make the microcomputer increasingly affordable to even the poorest schools. Recognizing the potential of micros, schools always seem to find the money. There are even stories of student-organized bake sales or book drives being held to raise money to buy computers. The federal government, though unlikely to officially launch a nationwide effort to computerize schools, already provides money, through existing grant programs, that can be used to purchase computers. Malcolm Davis, director of Educational Technology in Washington, says, "We are cognizant of the fact that microcomputers are a hot item." And though he declines to say that the Department of Education will come forth with a specific policy concerning the use of micros, Davis concedes that the feds are working to serve as a clearinghouse of information, particularly in software evaluation. "We're here to help," Davis says.

As mentioned earlier, one of the prime motivators in this entire micro revolution is profit. "There's no ques-





tion that it's a really dynamic marketplace for us," admits G. Gregory Smith, director for educational marketing for Apple Computer Inc., the leader on the school scene. "The acceptance in the educational environment has gone much wider than we had anticipated."

Looking further down the road, computer makers are eager to bring micros into the home, a market which has far greater potential in the long run. The sales principle here is to build up brand-name loyalty among enthusiastic students, who will then run home and tell their parents to buy a computer "like the one we have in school." One manufacturer spokesman estimates that for every unit sold to a school, there is the potential for two home sales.

This sentiment is shared by Charles Phillips, senior vice-president of Special Markets at Tandy Corporation's Radio Shack Division. "We're trying to drive this market to the homes," Phillips says, "by supporting all kinds of things—electronic journalism, electronic banking and things of that nature. I think that education is an integral part of driving the computer to the home because the child learns on the machine at school, so this is what Mommy and Daddy have to buy him. All the forces, when they come together, will cause the home

explosion."

So there are no major problems in getting the computers themselves into the schools. Rather, in this initial stage, the larger question is, "Now that it's here, what do we do with the thing?" And therein lies a formidable challenge, one that should probably be divided into the two most-oft-cited obstacles: how to train teachers to maximize the microcomputer's incredible capacities, and how to provide quality software to meet the same ends.

"It's probably the most pressing problem that currently faces the use of computers in schools," remarks James Poirot, in reference to the teacher-training issue. As chairman of Computer Science at North Texas University, Poirot also coordinates the annual National Educational Computing Conference, a gathering designed to formulate intelligent applications for micros in schools. "No matter how many systems and how much software we have, unless our teachers are trained and feel confident with the utilization of the computer, it's going to be used ineffectively—or not at all—in the schools," concludes Poirot.

There are a number of approaches being taken to first familiarize teachers with the basic equipment and later instruct them in the integration of the com-

puter into their curriculums. The simplest method is some kind of seminar or workshop, whether provided by the school itself, a nearby university or extension school, or by the hardware manufacturer itself. This typically involves a few hours of getting to know just how the machine works and what it can do. Most teachers graduate to more advanced programming courses and attend informative conferences and meetings sponsored by the multitude of educational groups forming in response to the micro revolution. A spin-off business—computer consultants and trainers—is also riding the movement's coattails.

Teacher training goes beyond this to include the responsibility of the instructors to find out as much as possible about what they're getting into and how it is going to best improve the quality of education. After all, they are about to participate in a major monetary transaction and should be sure of the product before they sign the checks. "Use of the computer as a tool requires that the teacher know how to use that tool effectively," continues James Poirot. "We need to get our teachers ready to use the computer so that they can be knowledgeable in purchasing the computer. We don't want to wait until they buy it

and then, 'How do I use it?'"

Now the hardware is ready to be installed, and the teacher knows how to use it. The next step is to put it to work—to get the computer computing—which may be a worse dilemma than teacher training. This requires a consensus on exactly how the machines are to be utilized, and evaluation of existing software, or "courseware," a crucial process.

Just as the hardware manufacturers waited for a combination of right ingredients before they attacked the school market, so too are waiting the software producers. Most of what first appeared were programs for games and other non-educational products created by computer whizzes. Courseware developed at a slower pace, mostly because the market simply wasn't there. And a majority of the educational programs presently available are written by persons with no teaching experience, resulting in courseware that is often confusing, complicated, too general and that does not take advantage of the computer's unique abilities.

"Random House started at just about the right time," says George Rosato, general manager of the company's school division. "We started at a time when we anticipated the market would be sufficiently large to absorb products that we produced. I think that maybe at the end of ten years [the school computer market] will compare with the textbook market, which is about an \$800 million market."

Rosato also feels that courseware producers are going to include not only the traditional old-timers in the education market, publishers like McGraw-Hill, Macmillan and Scott Foresman, which are all launching a major software blitz. "There are a growing number of producers," says Rosato, "who produce from the vantage point of their own homes... I think there's room for a new kind of publisher in this business."

With so many players in the courseware game, the question of quality control is a tough one. Part of the problem is that no real standards have been established yet. There are so many publishers trying to get a foothold right now that it will probably be a while before standards are set. "Until the standards have jelled," says Rosato, "I think there are going to be a lot of new [software producers]. Then it's going to be a weeding out process."

Jack Roberts, editor of Scholastic Publications' new *Electronic Learning* magazine, feels that the road to quality courseware is going to be a two-way one.



"Educators and programmers are finding that they need to work together," Roberts says. "When a major publisher has a 'hit program,' this will set a standard for other publishers."

While Roberts asserts that major educational publishers are going to chart the software route, there is also a divergent school of thought, which brings up the essential question of exactly how the computer should be utilized in the classroom. Some experts feel that the micro is not yet being applied in the proper way. George Blank, editorial director of *Creative Computing* magazine, puts it this way. "Most present efforts to use the computer in the classroom are an attempt to simply do a mechanical translation of current classroom techniques into the computer environment rather than take advantage of the special abilities of the computer, and design a new way of teaching." Blank says that the editorial philosophy at *Creative Com-*

puter is in total sympathy with something that Seymour Papert, who developed a radical new language called Logo, said about the use of computers: "Let the child program the computer; don't let the computer program the child."

In general, the computer's use in the classroom is referred to as CAI, or computer-aided instruction. This breaks down into three general categories: drill and practice, in which the student simply repeats and reviews what the teacher has already taught; tutorial, which allows the student to go beyond the teacher's lesson; and simulation, which calls on the student to solve problems incorporating previously learned material. This latter approach is the type endorsed by people like George Blank. "The use of simulation in education is an example of the approach we prefer. The use of the computer for drill and practice is an example of the approach we abhor, basi-



cally because it's educationally oppressive. We don't want human beings to have their lives determined and run by machines. We want people to run the machines."

Seymour Papert's Logo language embraces Blank's attitude. Papert and a group of colleagues at the Massachusetts Institute of Technology's Artificial Intelligence Laboratory created a system that goes outside today's pedagogical limits. In his recent book *Mindstorms*, Papert describes his philosophy. "I see the classroom as an artificial and inefficient learning environment that society has been forced to invent.... I believe that the computer presence will enable us to so modify the learning environment outside the classrooms that much if not all the knowledge schools presently try to teach with such pain and expense and such limited success will be learned, as the child learns to talk, painlessly, successfully and without organized instruction. This obviously implies that schools as we know them today will have no place in the future."

Papert's concept is to introduce the child to the learning process very early using the computer as the integral tool. He wants to let the child learn basic ways of thinking about the world around him. "Indeed," he continues, "the role I give the computer is that of a *carrier* of cul-

tural 'germs' or 'seeds' whose intellectual products will not need technological support once they take root in an actively growing mind."

Though Papert's ideas seem wiser when considering the capabilities of the computer, it's not likely that the educational community will go in this direction at any time soon. However, Texas Instruments, which largely financed the development of Logo, is just beginning to offer the system with its micros. TI's James Miller concedes, though, that it may take a while for Logo to gain acceptance. "The school market doesn't grow that fast," he says. "They don't acquire things that quickly, but there will be a growing number."

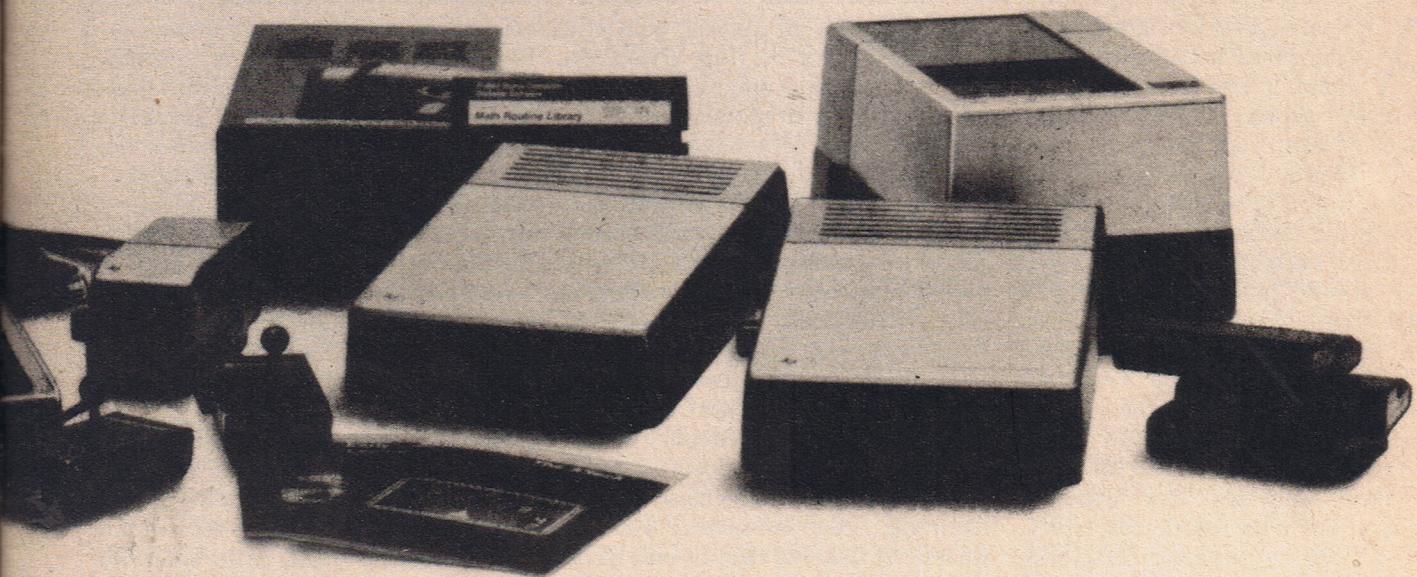
Apple and Atari micros will soon offer Logo capabilities as well. But Apple's Gregory Smith echoes Muller's apprehensive sentiments. "Computers themselves are radical to the traditional education establishment," Smith says, "and then if you carry that into the content being radical also, that's a hard one for them to swallow."

Another pressing issue with courseware development is a legal one concerning copyright and reproduction laws. To date, there are no hard-and-fast restrictions to keep teachers from buying one program and simply duplicating it. Random House's George Rosato recognizes

the problem, and the fact that the law is still very fuzzy in this area. "What's clear," he submits, "is that it's unethical, immoral and at the very best probably in all cases illegal to copy without permission. But it's done very often and very easily." Rosato hopes that a self-imposed honor system will develop among educators and that ethics alone will alleviate the problem.

The use of computers in the classroom is still in its infancy stage. As the information explosion continues, the computer will become much more of a necessity than a choice. In his book *The Micro Millennium*, computer expert Christopher Evans reiterates this point. "The truth is," Evans writes, "that the world is about to move on from the era where knowledge comes locked up in devices known as books.... In the era it is about to enter, the books will come down from their shelves, unlock and release their contents, and cajole, even beseech, their owners to make use of them." The computer, he insists, is the liberator of this knowledge.

Teachers, administrators and parents will have to carefully study the now-confusing computer frontier. Aside from facing the major philosophical questions on exactly how to apply micros, they will have to tackle the practical problems of teacher training and soft-



ware evaluation. *Electronic Learning's* Jack Roberts advises schools "not to just jump in until they have done their homework, until they have studied and learned about what computers can do, and to find out what they would like them to do for their schools. All of this is a fairly time-consuming process," he admits. "but it's very important."

George Blank at *Creative Computing* recommends that schools institute at least a full year of gradual use of computers before making major commitments. He suggests initially putting a number of micros into some sort of a computer center and allowing students and teachers to just familiarize themselves with the equipment. "Towards

the middle of the second year," Blank says, "go into a serious analysis of what the role of computers in that school district ought to be. That's when you have to make your commitment as to whether you're going to put more computers in the schools."

The future of computers in education is still quite uncertain. But one thing for sure is that the computer age has arrived, and education will inevitably be swept up in it. Christopher Evans, in *The Micro Millennium*, says it quite simply. "Computers... are essential to the survival of a complex society, in a way that food, clothing, housing, education and health services are essential to a slightly simpler one. . . . The world needs computers *now*, and it will need them more in the future; and because it needs them, it will have them."



Kraftwerk: Evolutionary Agents With A Beat

At least a half-dozen looming skyscrapers are under construction within a five-block radius of where I'm sitting, yakking with Ralf Hutter of Kraftwerk in a small room within Warner Bros. Records' New York office. The sounds that drift in through the window to my right form the perfect backdrop to the interview in progress—the throbbing, morlock beat of piledrivers, cement-mixers' churning rumble, hissing acetylene torches and unharmonious shouting from the hordes of raw-throated workers swarming the construction sites like insects. Ralf, acting as spokeshuman for one of the most innovative and influential music groups of the past decade, is looking a bit pale but sits unselfconsciously erect as he patiently answers questions in a softly controlled, sibilant voice. He appears unaware of the post-industrial, urban *musique concrete* soundtracking our meeting. I suspect he finds it subliminally calming. I do.

It's not possible for me to exaggerate the importance of Kraftwerk's role as the cultural synthesists of the '70s. As the most visible portion of the post-psychadelic German avant-garde/rock iceberg, this quartet of "musical workers" (Ralf's self-nomenclature) has industriously cleared away the cultural underbrush in order to pave through an efficient, well-engineered autobahn uniting the territories of electronic and pop musics. Sharing a background in classical music, Ralf and Florian Schneider came together in the late '60s to find something more satisfying than the rigid traditionalisms binding them into the Western classical context. "The musical world is very reactionary," Ralf says. "In Europe there are too many opera houses and museums, everything is like a statue." He shrugs, and continues: "I just became bored with playing music that was already written out—reproductive. I once had a very thoughtful teacher who told me, 'Playing three notes from yourself on your instrument is far better than going to see the world's best production of some opera.' What you do yourself is always much more interesting, because we are all musicians. Culture is no longer the privilege of the

'genius'—that's all rubbish, bullshit to keep the rest of us from trying. So, Florian and I began discovering our own creativity, our own productivity."

The sound of early Kraftwerk didn't much resemble the music produced by the band today. Heavily influenced by the post-war, German experimental school (Stockhausen), their early music was dominated by an impressionistic electronic sensibility. "We started mostly with electronic feedback music, oscillators and contact microphones," Ralf recalls, "a very vague type of electronic droning sound." This led to the inevitable cubbyholing of Kraftwerk into the avant-garde/art music classification, electronic noise sub-species. He continues: "It followed that the only places we could play were modern art museums, city council centers, universities and that type of thing."

Ralf and Florian obviously found the prospect of a creative life confined to

this polite, artistic sinecure unsatisfactory. They continued looking for something more meaningful to them; "finding the Klangklang sound," Ralf calls it, using the name that encompasses the physical (studio), business (publishing) and conceptual aspects of their endeavor. It was a gradual process, requiring a great deal of hard work, both in long studio hours and in the psychic effort of breaking with the overpowering pressures of tradition and the demands of life.

Ralf stresses the importance of independence and autonomous self-production at this formative stage. "When we started we made our own studio—Klangklang Studio in Dusseldorf. We rented a workshop area, a loft, in the industrial sector and installed some cassette recorders, an old Revox machine, some oscillators, an old organ I had and some contact microphones of Florian's. We immediately got into self-production,

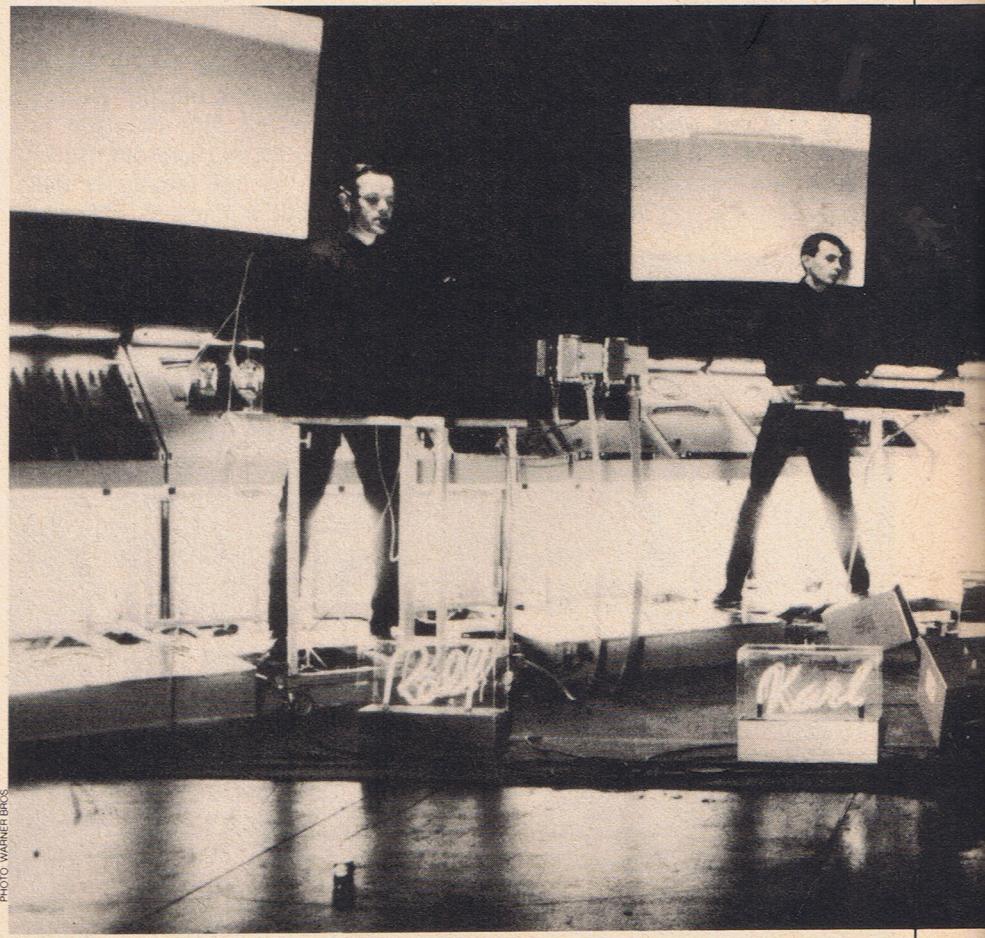


PHOTO: WARNER BROS.

which wasn't done very much then, but is very much the fashion now. I think we stimulated a lot of people into producing music for themselves—showing them you don't need to wait for a big Cadillac to arrive in front of your house and tell you, 'We've picked you to be the next Elvis Presley.' "

"The Klingklang sound" reached its first maturity with the release of *Autobahn* in 1974, Kraftwerk's first record to see print in America. The album was a pivotal one in that it was their first as a quartet (Ralf and Florian were joined by electronic percussionist Wolfgang Flur, and violinist/guitarist Klaus Roeder), and divided itself equally between the "old" sound on side two: light, evocative electronic tone poems; and the "new" on side one: the elegantly simple, post-industrial pop-trance music of "Autobahn" (which in an edited version was a Top-40 radio hit here). The latter was the direction Kraftwerk would pursue, refining artfully their romantic musical vision of an optimistic futurism. Released the following year, *Ralf &*

Florian was quite literally a throwback. Recorded and issued in Germany in 1973, it featured the duo in their pastoral, ethereal guise (both LPs came out on the now-defunct Vertigo label, and are all but impossible to find these days).

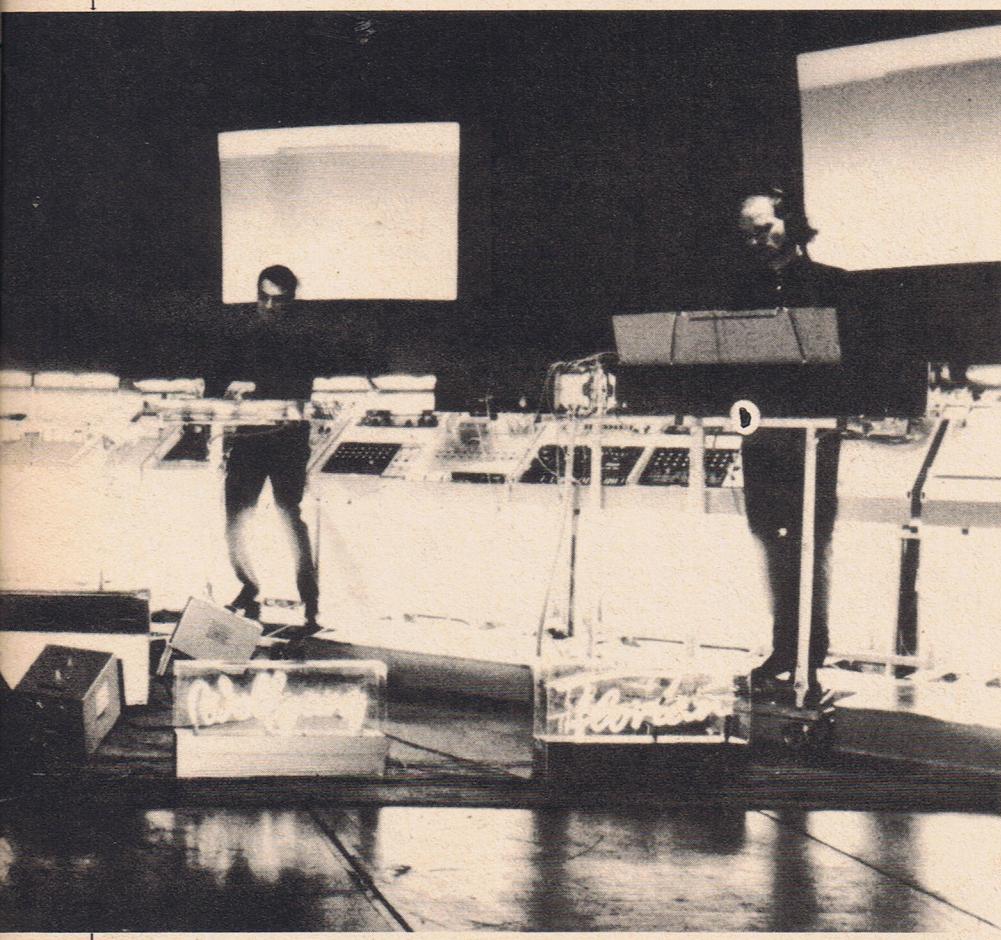
The trio of albums that followed: *Radio-Activity* (1975), *Trans-Europe Express* (1977) and *The Man-Machine* (1978—all on Capitol, and still securable if you work at it), show the group's tightening conceptual grasp in the purification/unification of sound and vision. The replacement of Roeder with percussionist Karl Bartos strengthened the rhythmic core of an almost-coalesced Klingklang sound, while Emil Schult contributed lyrics transmitting unashamed technophilia in simple, semaphored gestures. *Radio-Activity*, with its dreamy, nostalgic tribute to the late-night, experimental radio broadcasts of the post-war era, doesn't quite make it. It lacks something essential that *Trans-Europe Express* has all over the place. Perhaps simply the image it uses as its metaphor for futurism, trains as op-

posed to radio/radiation, works more effectively in a musical context. The electronic evocation of a train-track rhythm as leitmotif rivets the listener and animates the dancer—both "Trans-Europe Express/Metal on Metal" and "Showroom Dummies" from this LP were mammoth disco hits. Ultimately though, the music's success lies in the sublime balance of elements, the satisfaction induced at every level, and its ability to obliterate all boundaries previously drawn between stylistic partisans, racial groups, variant IQ levels and taste patterns formed by the multitude of musical response patterns. Perfection arrived with *The Man-Machine*, in the Bauhaus, form-follows-function purity and beauty of its melodic and structural work, the visual evocation of the Futurist and Russian Constructivist art movements of the '20s, and the deadpan self-parody implicit in their much-misunderstood robotic stance.

I ask Ralf if the band intended an ironic statement by juxtaposing early 20th-century, naive futurism with today's more morally ambiguous concepts of human-technology relations. He shakes his head vigorously and says, "No, just the opposite in fact. We find everything that came in the first decades of this century to be much more advanced than anything that came later. Everything since has been regressing—it's been a very reactionary period in Europe and America. Perhaps not in hardware, where advances have still been made, but on the software side we've seen people turning very reactionary. Fascism is rising, law and order systems, paranoia, control mechanisms... We were no longer looking to the future, just within ourselves to our own reactionary instincts. I think now we are ready for another circle, to go forward again, because we have seen how far it can go. We have no choice really, it's the only way considering how things are going." Ralf's hand points out the window to indicate the crowded, noisy and not-so-clean city around us. He winces painfully.

In a very real sense, Kraftwerk's music has acted as an evolutionary agent. Ralf recoils from the phrase when I put it to him, saying, "That sounds too much like we are patting ourselves on the

(continued on page 33)



INFORMATION NETWORKS

The Cybernation of Knowledge

By WILLARD VAN DE BOGART

An information network is an interrelated group of people who transfer the necessary data within the information network system to facilitate the phenomenon of human concept formation.

In the vastly complex system of 20th-century Earth, that small biological system known as *Homo sapiens* has become the recipient of an increasing and never-ending flow of information—cultural, political, scientific, what-have-you. We can no longer pass our lives passively accepting only the knowledge directly related to our existence—such as the price of wheat or how to make soap. Human civilization has evolved technologically to the point where each individual is constantly being bombarded by a series of new advances, new political developments, new areas of knowledge, to the point where that individual is physically unable to accept all the input and judge which is important and which can be discarded.

In order to adapt to and handle this vast flow of information, the human organization has almost unconsciously developed a method of sifting through and absorbing incoming data. We can call these new systems the Information Network.

Networking is essential to bridge the various disciplines of learning which are developing in the various sub-cultures of all areas of knowledge. The more science breaks into sub-groups, such as nuclear physics and mechanical engineering, the less communication is possible between scientists, and the greater chance knowledge will be slowed down due to the loss of meaningful communication. The Information Network has developed to ensure a cross-disciplinary approach to all aspects of knowledge enhancement.

Networking directly affects the information-behavior of the members of the various networks. The information-seeking behavior of humans has accelerated to the point whereby networks have

been created to transmit the most essential data for the continuance of mental evolution. This also implies that the network has taken on a very responsive character inasmuch as it is sensitive to the needs of its members. There are developed already very sophisticated information networks with computer terminals acting as display stations. These systems can be either private or commercial. For example, NASA has developed the RECON System that now has approximately two million information references with access to 300 or more other databases.

It is possible to compare the genetic structure of the human and the genetic structure of an information system. Human genetics has allowed the human



INFORMATION NETWORKS

form to come into the world through morphological evolution. The genetics of information generation deals with the psycho-epistemological development of the way the human mind has developed mental models by which to see the world. Many new thought forms are constantly being developed to account for the new observations that are being brought forth as the new measuring devices see more and allow our minds to re-conceptualize the world we live in.

Yoneji Masuda, founder and president of the Institute for the Information Society in Japan, talks about the formation of structurally organic information networks, which deal with physiological functioning of the human system and its relationship to the environment. This acknowledgement of information as an organic and growing entity is very similar to the actual structure of the new information networks.

In her book *The Aquarian Conspiracy*, Marilyn Ferguson sees this organic nature in networks: "This organic mode of social organization is more biologically adaptive, more efficient and more 'conscious' than the hierarchical structures of modern civilization." In other words, the actual amount of information is growing, but defining its structure is difficult, so the individual must seek other sources to more fully understand this development.

The most dramatic and new mental mode by which to observe the universe we live in is offered by John Archibald Wheeler, the physicist who helped to invent the theory of nuclear fission. Wheeler is also known for naming one of nature's strangest creations, the black hole. Wheeler summarizes his observation: "Of all strange features of the universe none are stranger than these: Time is transcended, laws are mutable and observer participation matters."

Essentially Wheeler is saying that the nature of the perceived universe is highly dependent upon the act of observation. You might say that what you see is what you think. Each thought is being integrated into the next thought, producing a new cumulative awareness of human nature and the universe we live in. These new mental models are being shared within the newly developed networks throughout the world. This on-going evolution of knowledge is branching out

into all areas of human inquisitiveness. One area which deals with the mind's ability to handle this high degree of processing is the development of psychopharmacology. This area of study is developing new substances which allow faster learning and better memory retention.

Medical research has found many chemicals that promote intelligence. However, intelligence boosters do not fall under FDA approval. Any research needs to be done via the new networks

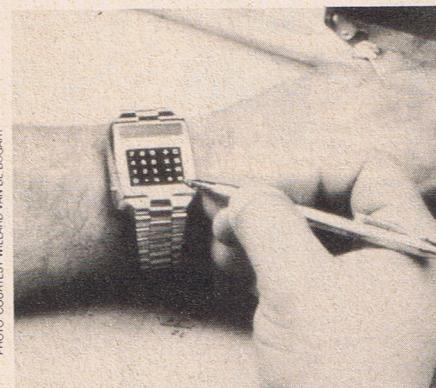


PHOTO COURTESY WILLARD VAN DE BOGAERT

Each thought is being integrated into the next thought, producing a new cumulative awareness of human nature and the universe we live in.

where a keen sense of evaluation is presently being pursued. In Pittsburgh, Dr. Rolf Von Eckartsberg of Duquesne University, friend of the leading researchers in psychedelia, has organized the Network for Nootropic Information and Research. It is networks like that which Dr. Von Eckartsberg is pioneering under professional supervision which are giving our accelerated culture information on mind-expanding substances. (Further information can be obtained from the Fitz Hugh Ludlow Memorial Library in San Francisco, CA.)

How do others see Information Networks? Dr. Albert Shapero of Ohio State University states: "Our Informa-

tion Networks are so much a part of our everyday life that we are hardly aware of them. The Information Network provides early and informal and rapid transmission of information that is generated within or enters any part of the network. The network provides its members with feedback without threat. The network establishes norms and values for its members and thus provides them with solidarity. The network is a validating mechanism."

The reason for the growth of networks is the expansion of the human mind to comprehend the universe. At 85 years of age, R. Buckminster Fuller wrote in his new book, *Critical Path*: "Mind, operative aboard our planet Earth and probably elsewhere in the universe in a myriad of effective circumstances, can and may perform the paramount function of conserving the scenario 'universe.' If so, it will have to accomplish by apprehending, comprehending and teleologically employing the metaphysical, weightless, omni-intercooperative generalized principles of universe in strategically effective degree and within a critical time limit."

The keyword here is "omni-intercooperative," which is Fuller's way of identifying networks. Information Networks are developing so that people can learn and share their ideas. But why is it that these Information Networks are developing to share information when there are already plenty of established information centers: libraries, schools, universities and similar international organizations? The answer is that the Information Network can do it faster, utilize less energy, and is more humanly responsive than the conventional institutions.

What are Information Networks exchanging? They are exchanging any and all thoughts that aid in the positive growth of a world civilization in preparation to explore other star systems within our galaxy. Addressing this idea of a larger network with global as well as galactic implications is Howard Kurtz, of the War Control Planners, Inc., in Washington, D.C. Kurtz has proposed a "Global Information Complex," suggesting "that the size and facilities of the mission of NASA's Goddard Space Center be greatly expanded to provide the same leading-edge for a new generation of all nations, or global, research,

INFORMATION NETWORKS



The author demonstrates the inability of the human system to absorb today's data deluge. New ways must be found.

development, testing and evaluation (and eventual shared operation with other nations) of space systems, and institutions serving the common needs of all nations, large and small. This center should coordinate the facilities of other government departments and agencies dealing with space applications."

Also involved with a global network is Carol Rosin, director of the International Association of Educators for World Peace. Rosin has appointed a "chancellor" for each state in the United States whose function is to coordinate and disseminate vital information that can aid in world peace. Rosin is working for a peaceful and permanent manned occupancy of space. This has also been a goal of Barbara Mark Hubbard for the *Committee for the Future* in Washington.

William Sauber from Dow Chemical

Company has written in his book, *The Fourth Kingdom*, "Living events can therefore be the purposeful arrangements of the same energy. The very existence of the living cell says that multitudes of events will be arranged throughout all the life system. Events can be arranged across, between and among all life's creatures. The total network of life can thus be programmed and tuned by evolutionary change to solve new problems."

There are now countless numbers of Information Networks to direct and focus ideas relevant to human evolution. These ideas transcend ideological differences. In fact, the Information Networks arise at this time so that we can witness the ideological differences with a certain amount of completeness, and also see how these differences are creating an impossible situation for the inner

mind to maintain tranquility, a sense of harmony. The "Consciousness Synthesis Clearing House" in Redondo Beach, CA, states that it is "evolving a general understanding of the networking process and the development of an overarching perspective from which to view this vital phenomenon."

Many new ways of thinking are developing as new discoveries are made in the many branches of knowledge. Institutions are static structures and do not exchange new ideas as quickly as they are exchanged in the Information Networks. Therefore, there are insights about what is going on in the world that could not be revealed as effectively if it were not for these networks. The Information Networks are very responsive to the flow of data through the mind. The biggest challenge for world civilizations is to adapt to these new discoveries and

INFORMATION NETWORKS

at the same time chuck existing ideologies if the very underpinnings of these ideologies do not serve a transnational implementation. The Information Networks have already moved their new findings across national barriers, largely because the human mind is growing to its ultimate "Omega Point," to quote Teilhard De Chardin, or to the "Psychosphere," to quote Dr. Oliver L. Reiser, author of *Cosmic Humanism*.

The Information Network is aware of current research being done by all aspects of science. The Information Network is also aware of political decisions and their global implications. This network shares in the ideologies and philosophies of those people that have integrated universal operating principles or laws of nature into an understanding of human evolution.

The Information Network is diverse

in its structure as well as in its function. The laws of nature which are used in the Information Network are developed in departments of Information Science throughout the universities of the world. Within these departments networking is analyzed by the discipline of Informatology, pioneered by Dr. Anthony Debons of the University of Pittsburgh. Informatology is not biology or psychology or sociology. However, informatology studies the laws within each of these sciences mentioned and more. In examining information as a system of interrelated bits of data, an understanding develops on how epistemology as a science is evolving.

Epistemology is the science of knowledge. What does humanity know or not know? Libraries and the enormous computer networks are definite signs that we know something. What we do not know

is difficult to observe or measure since in our unknowingness there is no attempt to create something. However, many people in the Information Network have data which are historical in nature and also predictive in nature. Predictive information is a result of developing a state of consciousness or knowingness which is in symbiotic relationship to the various branches of human activity.

The Information Network has information about predicting the cycles Earth goes through as it orbits the sun. As mentioned, NASA has access to over two million documents, all coded so there is cross-indexing of any initial input.

For example, Benson Herbet from the Paraphysical Laboratory in Downton Wilts, England, wanted to know if NASA had any information on infrared measuring devices that would pick up ra-

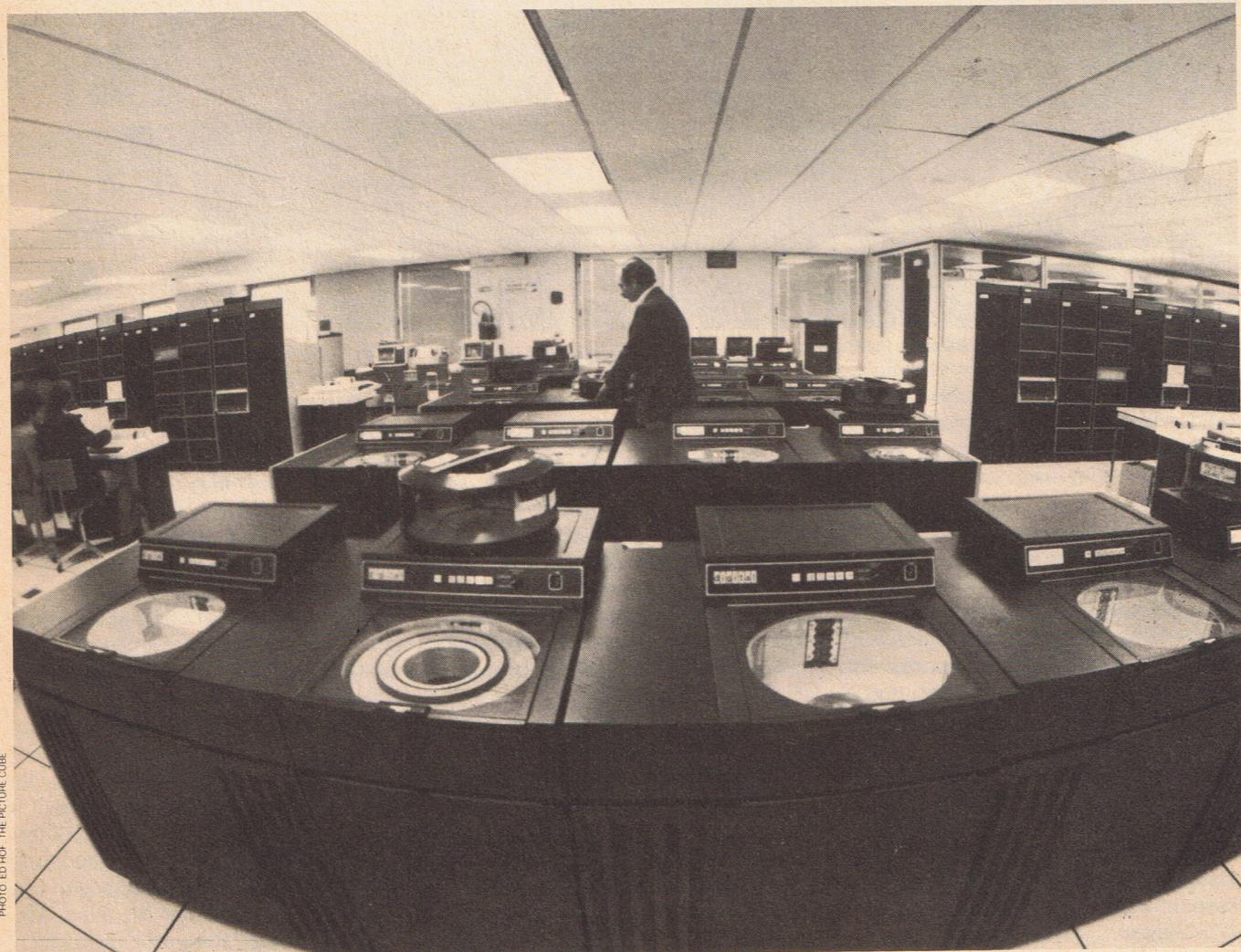


PHOTO ED HOF: THE PICTURE CUBE

High increase in data access is causing great concern among the security councils of nation states.

INFORMATION NETWORKS

diation from the human body. At the time, he was doing research on infrared radiation from the human hand. Duplessis believes the skin has thermal sensors which can translate the reflected infrared radiation which comes from the skin and if this reflected radiation comes from a color, it can be translated in the mind as that color. This would be a breakthrough for blind people who would have an added dimension to their reading.

But NASA is only one information source in the total Information Network. To estimate how many sources there are in the world is impossible. As the year 2000 approaches, the collective consciousness of humanity will be directly experiencing the increased amount of knowledge which is necessary to define planetary civilizations. The increased complexity of the interrelated social fragments constantly demands that these human minds develop a guidance technology to maintain human evolution.

Information Networks comprise such an interrelated group of human minds which transfer information within the network to handle the increased complexity of knowledge accumulation. The amount of transfer is directly related to the needs of fulfilling those perceptions of reality which promise to contain paths human evolution may take. Some of the paths which are demanding information are:

- 1.) New advances in productivity necessary for a growing and noninflationary economy.
- 2.) Developing new jobs by fostering the creation of high-technology companies.
- 3.) Protecting environmental quality and human health and safety while enhancing productivity.
- 4.) New opportunities in education.

This list could extend for a long time. In late 1980, Congress passed the Stevenson Wilder Act which makes it mandatory that all Defense Department research labs transfer their knowledge to the public sector. These research areas include computerized manufacturing procedures as well as robotics and artificial intelligence machines.

On April 8, 1981, the *Congressional Record* announced the passage of the Information Science and Technology Act.

This bill is designed to enhance the United States' leadership in information science and technology by establishing an Institute for Information Policy and Research. This type of legislation represents a distinct recognition of the need to address the accumulation of knowledge and what structures can be developed to best utilize the wealth of human ingenuity. The Information Network has already responded to this need by developing a community of people who share information on all sorts of disciplines.

Within the Information Network



The effort to migrate into space will come about as the planet Earth begins to reach a unified collective mind field.

there is a clear understanding of how information is developing into knowledge and wisdom to insure our survival. In a very real way we are at this time in our history experiencing the phenomenon known as war and peace. These two forces have been in existence and resonating since we first began to develop our ingenuity to stay alive on planet Earth. The Information Network is well aware of the human ability to control these forces for the purpose of guiding civilizations into the next millennium, only 19½ years away. There is plenty of literature now available about the coming apocalypse, popularized as the "doomsday philosophy." Not to sound

trite, it is better to refer to it as "birthday philosophy." The Information Network has many groups that believe humanity is about to go through a chrysalis stage in evolution. What will emerge is not the Frankenstein of the doomsayers but a global linkage of intelligence that has learned to harness the electromagnetic resonant frequencies which are the biological structural frequencies governing life.

Transferring information leads to power. This issue has been brought up by Dr. Jonathan F. Gunter of the Communications Satellite Corporation to determine if national security is weakened by making available to anyone all of the available information. This type of thinking suggests that control is a result of increased data-handling capabilities. High increase in data access is causing great concern among the security councils of nation states. There is an obvious justification for thinking the more data you have the better chance you will have to make a better decision or solve a bigger problem.

However, the Information Network I am referring to is a network which has unique perceptions related to the evolution of the human race. The social systems which comprise the world stage literally contain thousands of interpretations on how social forces should be governed. The differences in social systems exists everywhere and these differences can also be seen and reflected in the drastic differences in individual behavior. The Information Network shares the data across national boundaries freely. Even though there are secret aspects to data handling, which can be called valuable information, and any communication of this information would breach a nation's state laws, nonetheless that information is freely exchanged.

At NASA Headquarters there are plans being finalized for space migration. The colonization of space is receiving top priority at this time. This effort to migrate into space will come about as the planet Earth begins to reach a unified collective mind field. The Information Network is aware of the needs and precautions that are necessary to guide all civilizations into this Birth Day of planet Earth when a common citizenry can begin a galactic search for extraterrestrial intelligence.

The Case for MARS

By STAN KENT

The red sands of Mars have always fascinated the peoples of Earth. Mars as an ancient god of war, Mars as a drought-ridden planet dependent upon canals for its civilization's survival, Mars as the dispatcher of Earth-conquering probes and Mars as the site of the vicarious explorations of the Viking robots—the Red Planet has tantalized Earthlings with Martian mysteries. It is therefore no surprise that over 10,000 people contributed a total of \$100,000, and continue to contribute thousands a week, toward the continued operation of the Viking landers on Mars. And of those 10,000 potential Martians, many voiced a sincere desire to see a return mission to Mars with both robots and people. Such a mandate cannot be ignored, and when the Mars Study Group at the University of Colorado approached the Viking Fund with offers of help, the University of Colorado Space Interest Group was born.

Nestled in the shadows of the Rocky Mountains at the University of Colorado's Boulder Campus, the first "Case for Mars" conference took place April 29-May 2, 1981, after only six months of planning. The conference featured some 25 papers covering all aspects of Martian exploration—past, present and future.

After an excellent summary of the Viking mission by Dr. Conway Snyder, Project Scientist for Viking at the Jet Propulsion Laboratory in Pasadena, California, a particularly novel concept was publicly debated: Dr. Fred Singer's Phobos-Diemos (Ph-D) proposal. In Singer's concept, Phobos and Diemos would be used as a beachhead for a manned ex-

pedition because of the lower energy requirements of landing on one of Mars' moons as opposed to the planet's surface. The Phobos-Diemos beachhead would be used for launching a variety of unmanned probes to the Martian surface as a means to establish the most likely landing site. Criticism of the Ph-D proposal focused on the potentially anti-climactic nature of going almost to the surface with people, but not quite all the way: a perpetual Martian version of Apollo 10. A special workshop on the Ph-D proposal was convened to resolve some of these issues, and a consensus was reached that the Ph-D proposal would make an excellent first step in a planned program of human exploration of Mars.

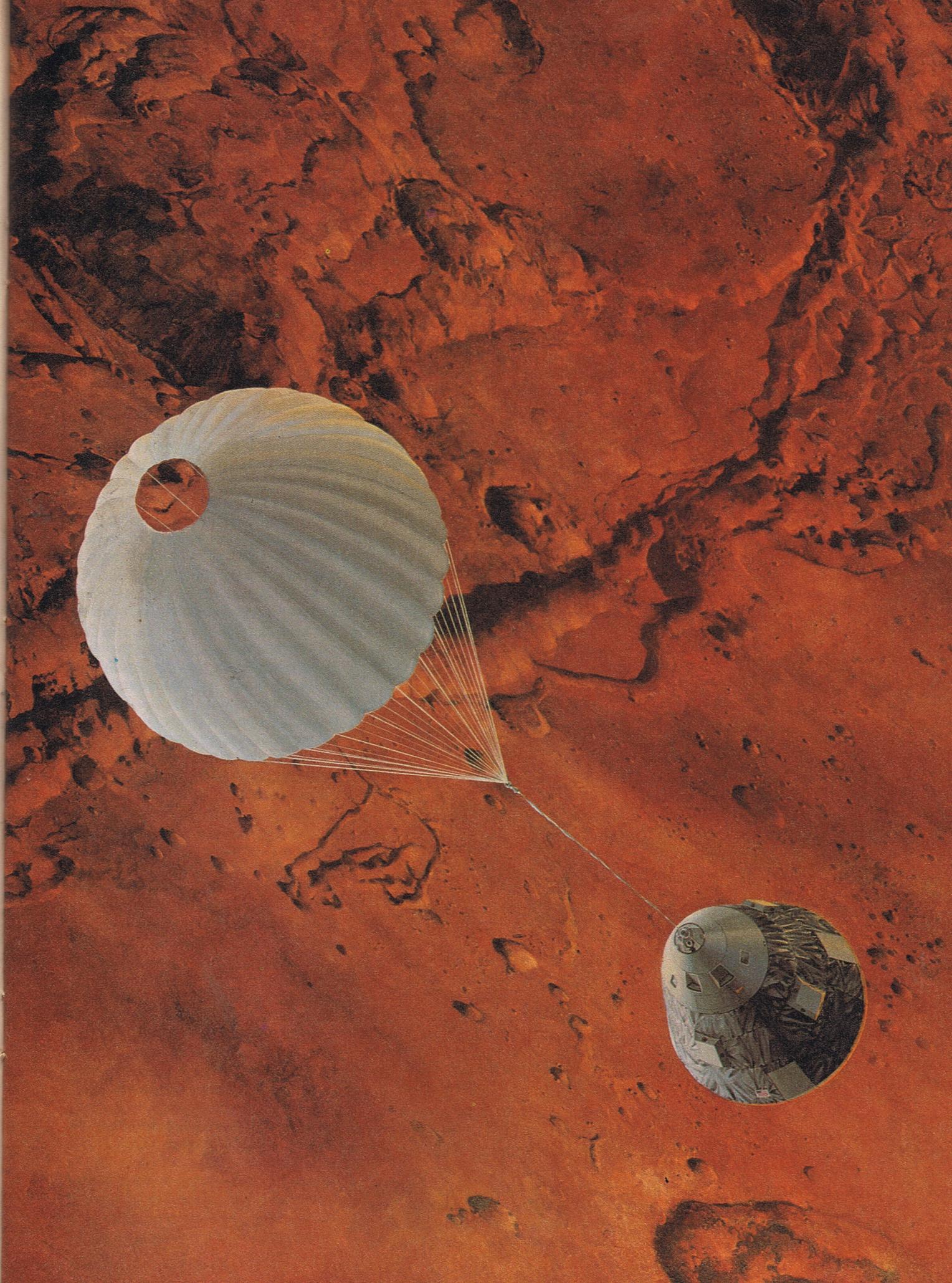
Other presentations focused on future unmanned exploration options, propulsion concepts for Earth-Mars transit, life-support systems, potential surface activities and eventual settlement plans. Often, several presentations came into direct confrontation over the best or most cost-effective means of achieving a particular goal, but such was the purpose of the conference. Items of contention became subject matter for workshops to focus on, and many innovative solutions were forthcoming from the long nights of heated discussion. The Case for Mars differed from most technical conferences because of the workshops, where the results of the conference presentations were massaged, discussed and abused.

The workshops were guided by the philosophy of establishing a continuous human presence on the Martian surface; "the Prime Directive" of the con-

ference, so to speak. There were workshops on all aspects of a Mars settlement program, and it was in these sessions that the Case for Mars evolved. In particular, there were sessions on Mission Strategy, Spacecraft Design, Life-Support Requirements, Surface Activities, Social and Political Considerations and the Ph-D proposal.

The Mission Strategy Workshop focused on the logistics of realizing the Prime Directive. This workshop concluded that even though a simple Apollo-type Mars mission is feasible at the present time, for the best return both economically, scientifically, and for national prestige reasons, it is essential to maintain a *permanently* staffed research base on the Martian surface. But before human beings ever set foot on Mars, a program of unmanned precursor missions is needed to pave the way for the "Martian Giant Step." The information returned by the unmanned probes would be vital in guiding the planning of the soon-to-follow human emissaries. Therefore, the Mission Strategy Workshop identified a Mars orbiter designed to search for volatile substances, such as water, as a key next step.

Once a landing site for the first human beings on Mars has been chosen, and the crew subsequently landed on the surface, their first task would be to construct habitat and life-support facilities for follow-on crews. Mission itineraries would provide for incoming and outgoing crew overlap so the first "Martians" can exchange information and provide guidance to facilitate a smooth transition from one crew to the next. The



consensus of the Mission Strategy Workshop was that the Mars Research Base must be a gradually expanding one, and that the base should grow as rapidly as reasonable, and become independent as soon as possible. In order to maximize efficiency and permanence of the Mars Base, Martian resources must be utilized to their fullest extent. Only then, the Mission Strategy Workshop concluded, would the ultimate goal of autonomy from Earth be realized.

The next step in planning a space program of this kind is to consider possible spacecraft designs for the Mars expedition. This was the task of the Spacecraft Design Workshop. The philosophy of this workshop centered around use of the space shuttle external tank refurbished and fitted out much in the manner of the Skylab orbiting laboratory of the 1970s. The volume of the external tank is many times that of Skylab, and the necessary

retrofitting can best be done in space. The equipment and materials to accomplish retrofitting would require several shuttle payloads for transportation to the orbiting assembly point where the construction of a Mars transit vehicle could be accomplished.

A brief analysis of chemical propulsion requirements for a human on Mars demonstrated that over 100 shuttle launches would be required for manned excursions to the planet. Investigations of the alternative methods of reducing this number of shuttle launches led the workshop to a higher performance propulsion technology: SEPS (Solar Electric Propulsion), sometimes called "ion drive." (See FL#26) With this system, a large solar array (many hundreds of square meters) is used to power very low thrust, yet extremely efficient, electric rocket engines. Since these engines are so efficient, the amount of fuel required to

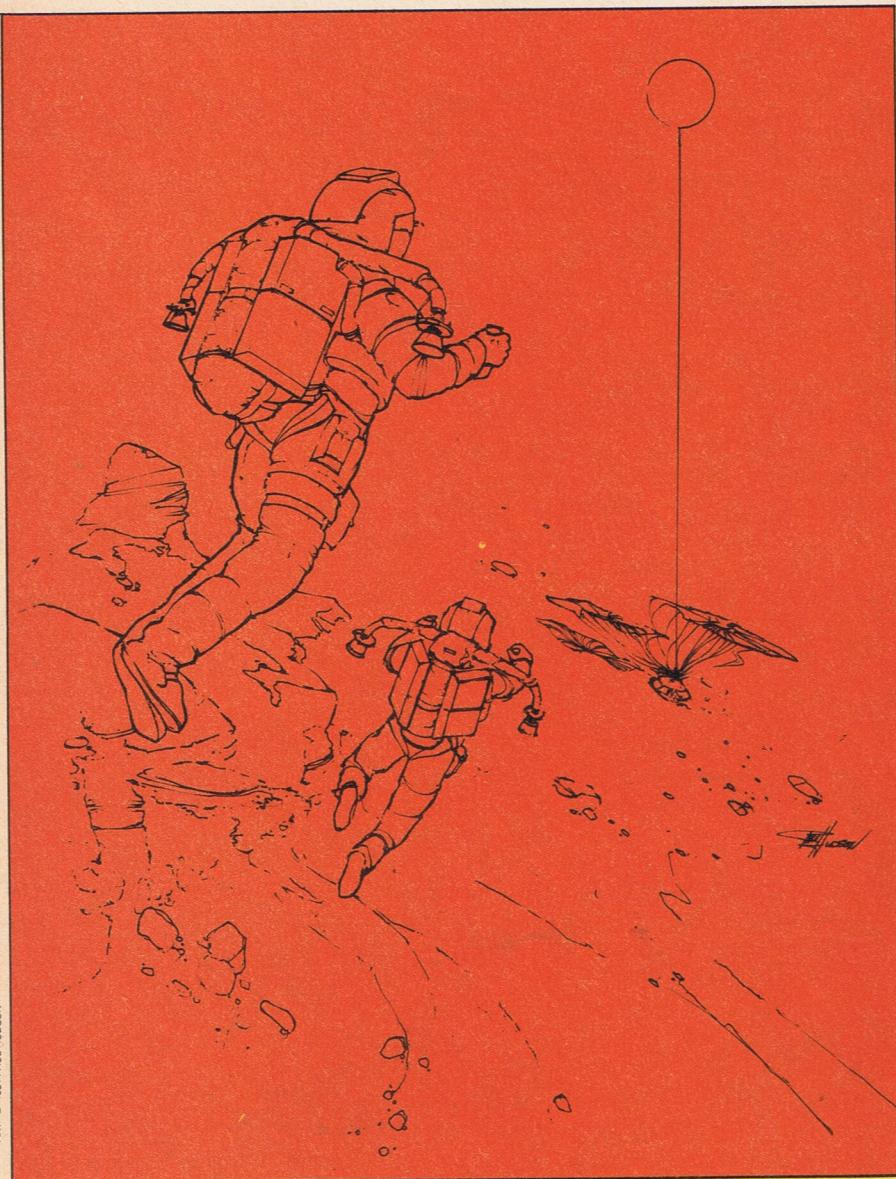
mount a human Mars mission is reduced by almost a factor of 10. Rapid calculations indicated that only 20 or 30 shuttle launches are required for this concept, and even though SEPS is a relatively untried propulsion system, its essential nature to mission success became evident, and this mandates a vigorous program of development.

The SEPS system is a highly versatile one. The SEPS transit spacecraft is also usable upon arrival at Mars as a very powerful electric power source. This electricity would prove invaluable to the workers on Mars because it would eliminate the need for the transport of bulky nuclear power sources. The SEPS power could be beamed to the surface via a Martian version of the solar power satellite, and portions of this power could also be used in orbit for powering of Martian orbital facilities.

The shuttle external tank spacecraft would return to Earth orbit at the end of each mission. It would be refueled, restocked and readied to return to Mars with more crew, supplies and scientific equipment. To expand the possible spacecraft payload by minimizing fuel transport, the initial Mars research base could also begin to experiment with ways to extract fuel from the resources available on Mars.

Perhaps the most exciting possibility along these lines that the workshop discussed would be the mining of the Martian atmosphere for the inert gas argon. This gas can be used in advanced ion engines to deliver over twice the propulsive power of the current ion drive fuel: mercury. With this type of propulsive capability (more than 20 times the propulsive efficiency we are using in the space shuttle) the solar system could become a commuter's paradise. Today these advanced engines are in the developmental stage, and many experiments and tests need to be done. This experimentation, along with advances in other technologies, could lead to Mars becoming the staging base and refueling depot for the utilization of the resources of the rest of the solar system. This may include the potentially valuable minerals in the asteroids, the moons of Mars and perhaps even, the moons of Jupiter.

The next element of designing a mission to Mars centers around the vitally important problem of keeping the crew alive. The critical and complicated issue of life-support—keeping people healthy and happy on the voyage to Mars and on its surface—were divided into two main issues. First, how do you support a human crew during the flight to Mars?



ART © 1981 PAUL HUDSON

One of the challenges faced by any future voyages to Mars will be how to support and maintain human explorers and researchers on the planet's surface.

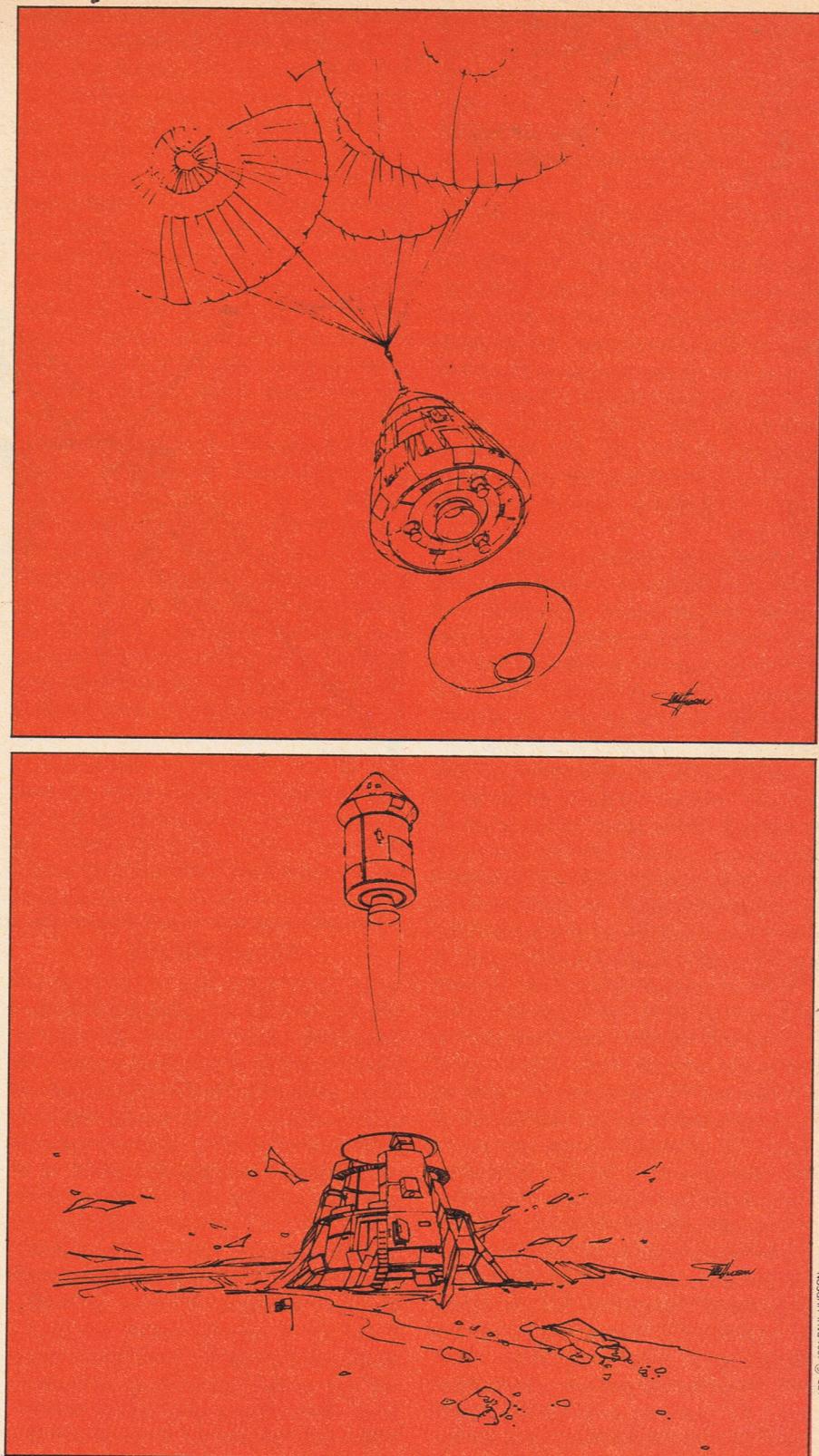
Secondly, how do you support those same explorers and researchers once they reach the surface? These were the major challenges facing the Life-Support Workshop.

This workshop provided a critical evaluation of the various chemical and biological methods of solving many problems involved in providing food, water and breathable air to human Mars explorers. The ability to use electro-chemical and physical life-support systems in the spaceship itself already exists. Methods developed for astronauts on the space shuttle and the Apollo lunar flights serve as a basis for a Mars expedition. Refinements and possibly some experimental use of algae and green plants to share life-support tasks can be included but are certainly not essential to the design of a Mars transit ship.

The "Prime Directive" to establish and maintain a permanent human presence on the surface of Mars allowed the workshop to supplement life-support with the tremendous variety of useful materials available on Mars and in its atmosphere. Many usable resources on Mars are already known from the Viking Mars landers and orbiters, and an extended unmanned survey will certainly identify more. To maintain people for long periods of time in space and on Mars requires provision for control of bacteria and other microbes within the habitat and prevention of the contamination of the Martian surface. This could be accomplished by well-known conventional microbiological techniques. The extremely small chance of contamination of Earth by any Martian life can be safely prevented by quarantine and sterilization in Mars or Earth orbit, on the return trip from Mars to Earth, or on an Earth-orbiting space station.

One of the most well-studied features of both the American and Russian space programs has been the effect of space flight on human astronauts, such as the medical effects of minimal gravity and other stresses of the space environment. These appear to be treatable with present medical methods. Long-term effects of the low gravity of Mars (one-third Earth gravity) on humans is a subject which needs research. However, the workshop assumed that the effects of one-third gravity are probably less significant than the effects of minimal gravity.

In planning a successful Mars mission, not only the physical health and nourishment of the crew but also their psychological well-being must be taken into account. Based on psychological isolation studies here on Earth, it is



The spacecraft used for a typical Martian mission will most probably be some sort of expansion on the presently existing Martian lander, using ion drive.

known that the minimum number of people for such a long-duration mission should be seven. In fact, in order to do all the work that they must accomplish on Mars, a crew of approximately 10 to 20 people would probably be needed to prevent deadlocks in command decision-making and to maintain a balance in personal relationships, an odd num-

ber of people is best. For crew selection a basic screening could be carried out to identify persons prone to mental difficulty from the stress of a Mars mission. Humans are capable of learning how to behave in difficult situations, and the men and women of the crew must be trained (rather than simply selected) to withstand the potentially dangerous

situations that may be part of any exploratory Mars mission. As a team, they must be able to maintain their calm and work together to meet whatever challenging demands arise. A great deal of further research into these areas must be done.

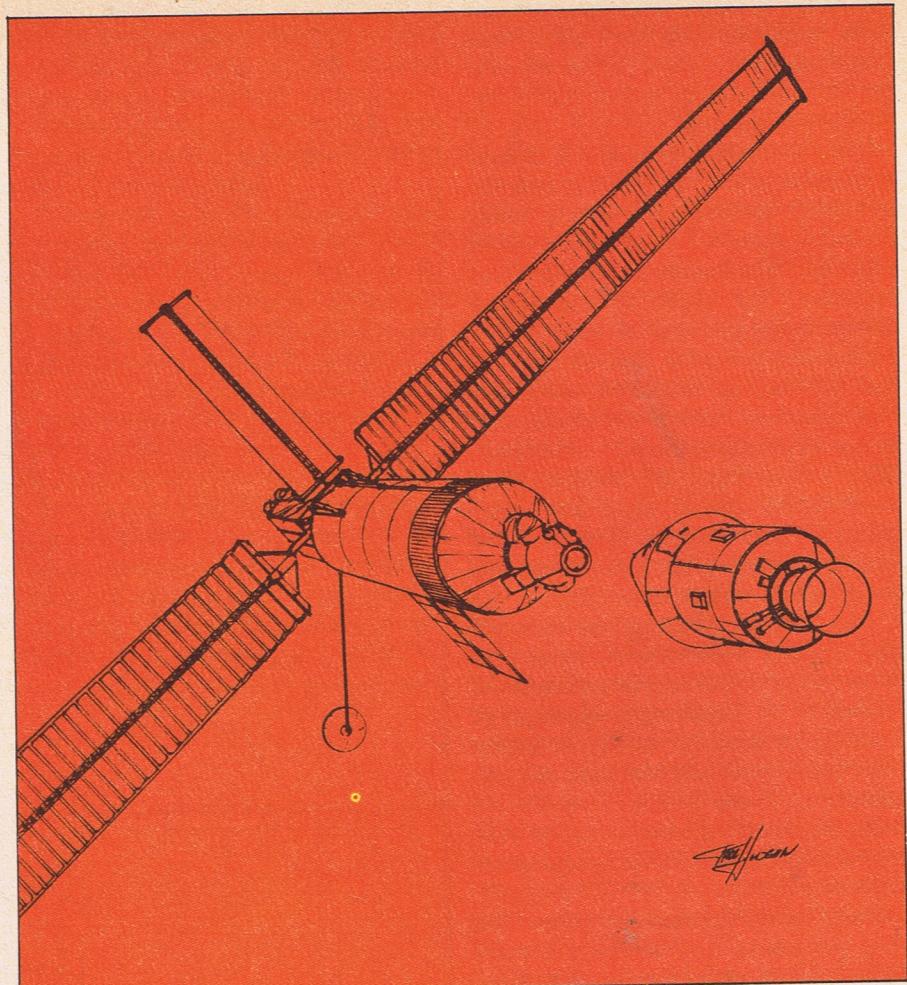
Once the problems of sustaining the crews have been solved, the next crucial item to be examined is: "What do the crew members do now that they are on Mars?" This was the subject of the Surface Activities Workshop, which divided activities on the Martian surface into two categories. One objective of surface activities is to evaluate Mars as a potential site of long-term habitation and colonization, and the other objective is to perform science-related exploration.

A preliminary mission is necessary to facilitate selection of a suitable landing site for the permanent basecamp. The unmanned precursor mission must verify the presence of water on the Martian surface, since this is the most important commodity necessary to sustain a crew. Once on the surface of Mars, there are several scientific objectives of immediate concern. Analysis of the soil is essential in order to determine what resources are available for use in a settlement base, and preliminary biological investigations must be performed to determine if terrestrial biology is toxically affected by exposure to Martian soil.

With an initial analysis of the Martian surface, the crew can best determine how to use Martian resources for the production of fuels, the construction of habitats and to begin simple manufacturing processes. On-site production of fuels is an extremely important aspect since the cost of a human mission to Mars could be dramatically reduced if the rocket fuel necessary for a return trip can be manufactured on Mars.

Scientific studies which could be performed at the base site include the search for Martian life. This could be accomplished by humans much more effectively than by robots because humans could interactively respond to experiments and change procedures to accommodate new information. The search for paleontological records of past life, if it existed, is also crucial. Evidence of life on Mars, past or present, would answer many fundamental questions about the origin and evolution of life on Earth, and again, human beings offer decided advantages over robots in this area.

Geological studies of the Martian surface would help us to understand climate changes here on Earth. Mars (which was



A reusable shuttle external tank will bring the necessary equipment to Mars.

much more Earth-like in the past) appears to be in an ice age of much greater magnitude than the past ice ages of Earth. A study of the climatic record on Mars, as recorded in the surface features and sedimentary rocks, would help us to better understand the nature of such climate changes, and perhaps avoid, or at worst prepare for, such events on Earth.

The last, but certainly not the least, considerations are the social and political aspects of an attempt to permanently establish a human presence on Mars. Contrary to popular belief, the major problems with the space program today are not in the science and technology area, but concern over social politics. This was a focus of the Social and Political Workshop.

The need for a space program has been obvious to scientists, but not to the general public. Large space programs such as the humanization of Mars, as with other international competitions, should be viewed as continuing phenomena. They involve the economics of transportation, industrialization, resource recovery and information, the strategies of military power and the prestige of leadership.

This workshop concluded it is important that all levels of the population of this country realize these facts and develop a deeper understanding of the increasingly vital role that space technologies and programs play in everyday lives, if the "Case for Mars" is to be supported by the public.

The conference finished on a high point with a panel session featuring, among others, Buzz Aldrin, the second man to walk on our moon. Aldrin opened his remarks by reminding the audience of the stupidity of saying it can't be done. "It is folly to cross the Atlantic by air" was uttered by Orville Wright just four years after he and his brother had successfully flown the Wright Flyer over the sand dunes of Kitty Hawk. And yet just a few years later the pioneer of aviation was proven wrong. Similarly, the "Case for Mars" is going to be the subject of much nay-saying and "expert" rebuttal. But, as Aldrin said, "public participation is the key," and considering that the conference was born from public request, then the mandate from the people is clear. The "Case for Mars" merely reflects that sentiment: On to Mars!

Soundscapes

(continued from page 21)

back." Though perhaps too self-congratulatory a statement for these modest musical workers, Kraftwerk has unquestionably exerted influence on the public consciousness, much as Devo has attempted but only partially succeeded at. Despite badgering refrains from over-analytical technophobes about their alleged "coldness" and "sterility" (anybody who says that is missing the point), Kraftwerk's accessibility and unpretentious transparency have done much to demystify the dreaded spectre of technology. By overtly constructing a positive image of technological evolution with their lyrics—the harmonious interfacing of Man with machine—and coupling them with sounds that soothe rather than jolt (smooth, pure wave forms and seductive, lulling rhythms) they have subliminally planted unthreatening notions of responsible progress in the mass-public subconscious. "Yes," Ralf grudgingly admits, "I suppose we are trying to do that, because we are not really entertainers." Oh yeah? Fooled me.

A good three years separated *Man-Machine* from this summer's *Computer-World* (Warner Bros. HS-3549). If, like me, you thought perfection of sound couldn't be improved upon, well ... think of it as the advancement of NASA's Clean Room over mere temperature control. Beyond this sparkle and polish, though, *Computer-World* doesn't mark as much of a quantum leap over its predecessor as previous albums have shown over theirs. But then, they're only human, eh?

What've they been up to for all this time, you ask? Converting Klingklang studio into a mobile performing unit, mostly. As Ralf explains it, "What you see on stage is our whole studio—it's like our living room. It's been broken down into units, everything packs in flat cases, and we can set it all up in one hour. It took a great deal of time and planning, because we constructed it to perfectly interface with our bodies. It is the end product of us working, not just for the last three years, but everything we did before that as well. Now we are going around the world with our studio."

Visually, the effect is breathtaking. When Kraftwerk played two nights at the Ritz here in New York, they totally dominated a cavernous and usually forbidding dance hall. Only Pink Floyd has succeeded in controlling an environment as effectively. The Klingklang set-up, a

modular semi-circular console that resembles an atomic reactor's control station (see photo), is truly awesome. The crowd voices amazement as the curtains part, much as a dazzled movie audience oohs when *Close Encounters*' mother-ship swoops in over Devil's Tower. The performance is pure drug-pleasure: hummable, watchable, dancable and lovable. The songs, touching on each LP from *Autobahn* to the present, form a seamless carpet of melodic texture and rhythmic pulse-movement. Behind them (my god, are those cold, teutonic automatons smiling, and—gasp!—having fun?), four industrial-strength video screens (each tinted a slightly different shade) supply droll commentary and visual reference points. As for the encore: during "We Are the Robots," simulacra stand-ins join Ralf, Florian, Karl and Wolfgang onstage (guess who's who!), after which the human halves stroll out from behind their equipment, step to the front of the stage and play "Pocket Calculator" on handheld toy instruments (found 'em in a department store last Christmas).

Awestruck as we may be, it's just another work day in the tough lives of four musical workers—and evolutionary agents at large. "We don't care about anything else," Ralf tells me, "we just do."

RECORDINGS

If any of you out there doubt my assessment of Kraftwerk's influence on the face of pop music, check out this batch of new releases. Suddenly we're flooded with electronic rock bands, some okay, some tediously unimaginative. Here in the USA we are only just beginning to feel the ripple of activity that's been squeaking and twitching in the UK for a good two years. Some of this stuff has somehow gotten the name "Futurist" attached to it (probably by the press; they never can get anything right), but little of what I've heard merits that tag at all. Example: *Classix Nouveaux* (Liberty LT-1104) and *Duran Duran* (Harvest ST-12158), two young limey bands that take much of their musical inspiration from recent David Bowie (that brittle, synth-based disco sound, without Bowie's tension or mystique), and visual flair (the more important of the two in their eyes, I bet) from a combination of early-'70s glitter rock and old movies. As dance music, the records ain't bad—good, strong beats, catchy, synth-led melodic hooks, and the proper balance of brevity and bombast to carry off a diverting three

minutes-and-change on the dance floor. As anything innovative or musically interesting, though, these guys flunk. Moderately intelligent synthesizer playing makes an occasional appearance (C.N. show more promise in this area), but lame lyrics (especially D.D.) and monotonously unvarying song structures steal the show. Both LPs are only half-good—a plus if they signal an outward-looking progression, a minus if they stake out all the territory these bands intend to explore. Future waxings should tell.

Landscape's *From the Tea-Rooms of Mars... To the Hell-Holes of Uranus* (RCA AFL1-4056) scores a bit better than the aforementioned—it's maybe three-quarters good. The band shows respectable synth chops, and their brains seem to be in the right places—but it's in the heart department where they strike out. Their music is ambitious but flat, too often plodding and lacking in real conviction. Some good-to-excellent moments crop up ("Einstein a Go-Go" and the rib-poking "Norman Bates," their two singles), but they are overshadowed by too much passionless, jazz-rock riffing. Landscape does get an "A" for effort, though, and Lou's Gold Star for Futuristic Awareness.

Orchestral Manouevres in the Dark predate the Futurists, but have only just released a record in America (so naturally, they've been grouped with the rest of 'em). *O.M.D.* (Virgin/Epic FE-37411) assembles material previously available on their two British albums (both excellent and well worth seeking out), and provides a good cross-sectional profile of the band. Included are such rock-club perennials as "Electricity," "Messages" and "Enola Gay," all reflective of the band's electro-pop side (excessively infectious, and dangerously same-sounding), additionally there's a sampling of their more "progressive" side, which I naturally find far more interesting in its subtlety of mood and expressivity. This one's for jerks who say a synthesizer can't match a guitar in warmth and human emotion.

Also worth checking out is an EP by Montreal-based electro-poppers Men Without Hats (points for the name alone), called *Folk of the '80s* (Stiff TEES-12-01). Young, buoyantly tuneful and promising.

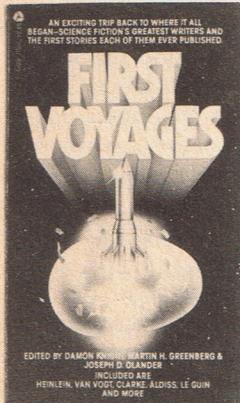
Early Warning: Keep an ear out for Yello's second album, *Claro Que Si* (Ralph YL-8159), due in mid-October. These guys have my vote as the post-Kraftwerk electronic band to kneel down for, and I'm counting on a knockout. N'cest-ce pas? F

In The Beginning

Beginner's Luck

When you're talking about first efforts, even from the best, you figure that things can go one of two ways—either these stories are going to be an embarrassment before God, man and the public eye, or they're going to be such a blantant show of talent that you don't know why this person took so long to be recognized. Well, neither of these gross generalizations hold true.

For example, in *First Voyages* (\$2.95 in paperback from Avon), a collection of the first sales of 20 of the genre's best (or most famous) writers, Damon Knight and company have chosen a group that not only includes such stalwarts as Heinlein, Van Vogt and Clarke, but an



exciting selection of more modern writers like Phil Dick, J.G. Ballard and Ursula Le Guin.

There is some fairly dire stuff here, but none of it is more than faintly embarrassing, especially if you take a look at the copyright page and see when they were published. Mostly, the stories are solid pulp thrillers like Theodore Sturgeon's 1939 "Ether Breathers" wherein the first color television broadcasts (occurring somewhere in the 21st century) bring about some alien editing of the airwaves. Similarly, in L. Sprague de Camp's "The Isolinguals" everybody in the world suddenly picks up a personality from somewhere else in time. They're both cute, snappy, typical stories of the time. Nice relics but no more than interesting.

Stronger efforts arrive in the form of Robert H. Heinlein's "Life-Line" which poses the question "Do you *really* want to know when you're going to die?" and Cordwainer Smith's "Scanners Live in Vain." Smith's debut is one of the most impressive—a terrific story about the personal cost of change.

My favorites are the debuts from the '50s, from authors who were beginning to try out some new forms, new voicings—the authors I grew up with. Phil Dick's "Beyond Lies the Wub" is still a pulpy punchline story, but the humor here is a little darker, more perverse than might have been allowed in years gone by. J.G. Ballard's "Prima Belladonna" reprises the old style as well, but there's a new jaggedness here and a hint of the spectacular effects to come from this writer. And finally, Ursula Le Guin's "April in Paris" shows a clear break with what's come before by touching on a tender, emotional magic that comes from her characters rather than from technology—a hint of the humanistic trends of the '60s.

This is a good genre history in a way. None of these stories broke entirely new ground. They just hint at the evolution of the field and the direction each of these writers will take. So you can read this collection to see what the market was like in those days of yore or you can read to see how the greats developed.

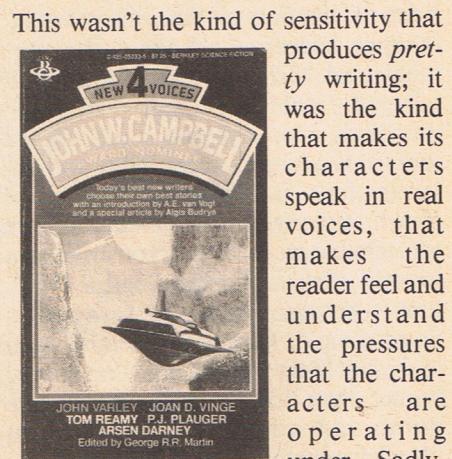
The New Beginners

Appropriately, one of the honors that bears John W. Campbell's name is the award for the year's best new SF writer. Every year since 1972 the publishers of *Analogs* have assembled a short list of new writers, the readers have voted on them and the award is presented at the World Science Fiction Convention.

This is a fairly conservative voting crowd as the list of winners indicates: Jerry Pournelle was considered the class of '73 (see what I mean about conservative), Lisa Tuttle and Spider Robinson tied in '74, P.J. Plauger got it by himself in '75 and Tom Reamy took it in '76.

There have been winners since Reamy, but since Reamy is the star of the latest edition of *New Voices* (\$2.25 in paperback from Berkley), a special annual collection of originals from the winner and nominees for the award, I'll stop listing them right there. Anyway, editor George R. R. Martin has put together a bright and shining little book here.

Reamy was a young voice and a good one in 1976—not great yet, but showing tremendous promise and sensitivity.



This wasn't the kind of sensitivity that produces pretty writing; it was the kind that makes its characters speak in real voices, that makes the reader feel and understand the pressures that the characters are operating under. Sadly,

we won't get to meet any more of these people because Reamy died in 1977, leaving behind only one novel (*Blind Voices*) and a single short story collection (*San Diego Lightfoot Sue*)—just enough to let us guess at what we missed.

"M Is for the Million Things" is one of a very few unpublished Reamy stories left and though it's not one of his best it does have some of the things that made Reamy a special writer. This takes place in a small town in Texas—one of those places where you know what time it is by what's on the TV; a town full of normal people. But here those abnormal desires, those things that are usually whispered around in the back of your head, are getting out into the world. It makes for a powerful, if truncated (Reamy never got to do the revisions he intended) tale.

There's nothing slack about the other four finalists you'll find here. Joan Vinge and John Varley have done terrific work since then, and M.A. Foster and Arsen Darnay have grown some.

Varley's contribution is an excellent piece entitled "Blue Champagne" that makes a real good try at showing just how much love can cost and how much freedom is worth. This may not be as elegant a story as his award-winning "Persistence of Vision," but it's just as strong and heartfelt.

M.A. Foster's "Entertainment" is a well-drawn world of the very distant future where leisure is all and an entertaining personality is what keeps you alive. The ending is a little abrupt, though, and a disappointingly mundane breakthrough for the hero weakens the story.

Arsen Darnay wanders off from his usually linear storytelling to try to give us the mythical overtone of a holy man's jihad. Despite the Khomeini-ish similarities, this little bit of religification is circular in the extreme and almost as boring as it is overwritten.

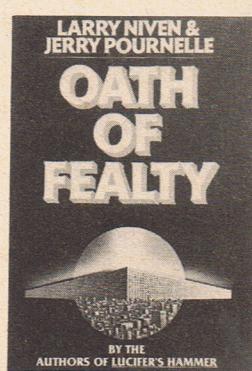
Joan Vinge is the final member of this foursome and her story "Psiren" is a fine addition to the growing body of her work. Here we have a crippled, mind-locked esper trying to help a beautiful and powerful psychic escape some very unpleasant taskmasters. This may seem a pretty conventional "man on a white horse" sort of story, but Vinge makes it considerably more. Both these trapped people, one in his own head and one by the needs of her body, find a way back into the world by helping each other. Their discovery that each is finally responsible for their own lives is a hard and telling lesson that makes this an exceptional story.

Beyond Beginnings

To see what happens when new voices grow up, check out Jerry Pournelle (winner JWC award in '72) and Larry Niven's latest effort, **Oath of Fealty** (\$12.95 in hardcover from Simon and Schuster).

Niven and Pournelle have turned in another guaranteed best-seller performance with the near-future story of a

giant arcology (thank you, Paolo Soleri) on the outskirts of Los Angeles—a very straightforward thriller, complete with lots of action and more than a touch of the pedant.



Todos Santos is a private city contained within a single, comfortable building. It is quite the libertarian place to be and a variety of outsiders, from ecologists to local politicians, see it as a real threat to the future of humankind. The Saints, as the inhabitants of Todos Santos are called, are under attack politically and physically (there ain't many things more physical than a bomb) and they're fighting back with a vengeance.

There are lots of nice touches. The

tour of the arcology is almost worth the price of admission, since the authors have done their usual rigorous research. Their speculation about the effects of straight mind-machine linkups between humans and computers is equally impressive. They even get into a little electronic telepathy that seems workable.

There are also some not-so-nice touches. These gentlemen are writing some real Reaganaut sci-fi, where villains are a uniformly liberal variety—fuzzy-thinking ecologists, bureaucrats and wrongheaded politicians—none of whom get to make a single logical or even rational protest.

This is just very old-fashioned SF and the authors are guilty of nothing more than overstating their case. If you want to know about a techno-utopia, here's your chance. If things go as they have in the past, you'll probably see a wave of new stories played out in very similar physical environments, modelled after Niven and Pournelle's new-style hometown.

Roots Reading

One of the best things about reading science fiction is that you don't have to depend on new voices. We can return to

any number of possible futures because the best of the old books are constantly being returned to the marketplace. Two recent reissues are a good example.

Fred Pohl and C.M. Kornbluth formed one of the genre's greatest writing teams and in 1952 they put together a scheme to get humankind off the planet that still looks like it could work. The book was **The Space Merchants** (\$2.50 in paperback from Del Rey Books) and the scene was (and is) disturbingly modern.

The U.S. is a blatantly corporate state. The President is a figurehead brought out for special occasions only. The country is run by the representatives of the mega-corporations. Advertising formulates and enforces public opinion. Economic slavery is a fact.

Enter Mitch Courtenay, Copysmith Star Class. Mitch embarks on an unwilling odyssey that will take him from the very top of his society to the bottom and back to the top a changed man—a man determined to see some changes made.

Pohl and Kornbluth weave a funny, insightful story that is just as fitting (and perhaps more so) today as it was 20 years ago. This is a must-read for anyone who hasn't and a should-read for any of you who haven't looked at it in a long time.

Another book that's returning to print after a long absence is Fritz Leiber's **Conjure Wife** (\$2.50 in paperback from Ace Books). Now this one may not be all that timely, but it is a really fun read—especially for all you guys out there who have been laboring at raising your collective consciousnesses about the women of the world.



This is a book with the wonderful theme that it's not our fault—that women are the ones who run things and men are, more often than not, simply pawns in the women's witchy games. Yes, Leiber asserts that all women are witches and what a relief that is.

This is the story of Norman Saylor, a college professor who discovers that his wife has been doing her witchy best to protect him from the wiles of the other faculty wives and compels her to stop all this foolishness. Then his life falls apart.

Not surprisingly, Norman gets a different kind of consciousness raised and in a real hurry. What we have here is a tale of quick switches, nasty witches, magic potions and high-speed frivolousness. It is a sexist classic in the very best sense of that word (if such there can be). Leiber believed that women were mysterious, illogical creatures who no man will ever understand and made an entertaining book out of it. Anyway, it's wonderful to see a war of the sexes where men are completely out of it. I haven't felt so innocent in months. And for you women out there it may be a treat to see the women of the world firmly in the (covert) driver's seat.



No. 2—

The Truth Behind Cosmos 954
Interview: Arthur C. Clarke
Tomorrow: Norman Spinrad

No. 3—

Quasars, Pulsars & Black Holes
The SF Films of Jules Verne
Tomorrow: Fred Pohl

No. 4—

Interview: Alvin Toffler
History of the SF Pulps
Tomorrow: Ben Bova

No. 5—

Interview: Ray Bradbury
Earthport: Space Station
Collier's 1951 Space Program

No. 6—

Architecture: Solar Houses
O'Neill's Mass-Driver
Tomorrow: Robert Anton Wilson



No. 13—

Genetic Engineering
Future of Rock Music
Interview: John Varley

No. 14—

Interview: Frank Herbert
Russian Space Art
Tomorrow: A.E. Van Vogt

No. 19—



Special art preview of Empire
3-D is alive and well
The cinema of nuclear disaster

No. 20—

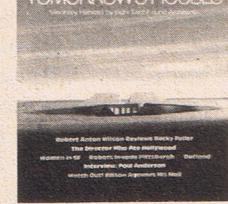
Articles by Bradbury & Ellison
Why the shuttle is Earthbound
John Lilly and the dolphins

No. 25-3rd Anniversary

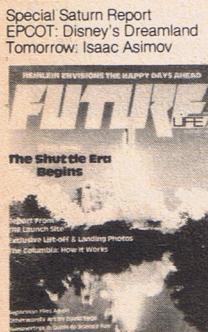


No. 26—

Ion Propulsion Rockets
Women in SF Films
Shuttle vs. Murphy's Law



No. 28—



No. 29—

NASA's Space Telescope
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Creationists vs. Evolutionists

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Creationists vs. Evolutionists

No. 7—

Future Planetary Probes
San Diego Space Theater
Careers in the Space Program

No. 8—

Arcosanti: Future City
Space Art: David Hardy
EarthSat: Computer Photos

No. 9—

Interview: The Real Albert Einstein
Planetaryariums, Space Art
Tomorrow: Jacques Cousteau

No. 10—

Interview: Timothy Leary
O'Neill: Space Colony Plans
Tomorrow: Roger Zelazny

No. 11—



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Jacques Cousteau • The Great Space Race
Space Back Stories • Larry Niven's New Novel
Science Fiction Art by Hall • Decoding TV's 'Star Trek'

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Aliens: Hollywood & NASA's
Holography & Videodiscs
Tomorrow: Larry Niven

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Cryonics and Immortality
Interview: Robert Silverberg



No. 15—

Frank Herbert on "Dune"
Russian Space Art
Van Vogt on Future War

No. 16—

Special Issue: Forecasting the Next Decade

Space-Age Games
Interview: Sturgeon

No. 17—

No. 17—2nd Anniversary

Real-World Robots
Looking for ESP
Tomorrow: Silverberg

No. 18—

Asimov on space science
10 scientific predictions
Trains of tomorrow

No. 21—

Robert Anton Wilson on
human intelligence
Homegrown robots

No. 22—

Preview of Cosmos
Futuristic sailing ships

The pro-space movement



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Is space worth the cost?
Interview: Norman Spinrad

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Tomorrow: Timothy Leary



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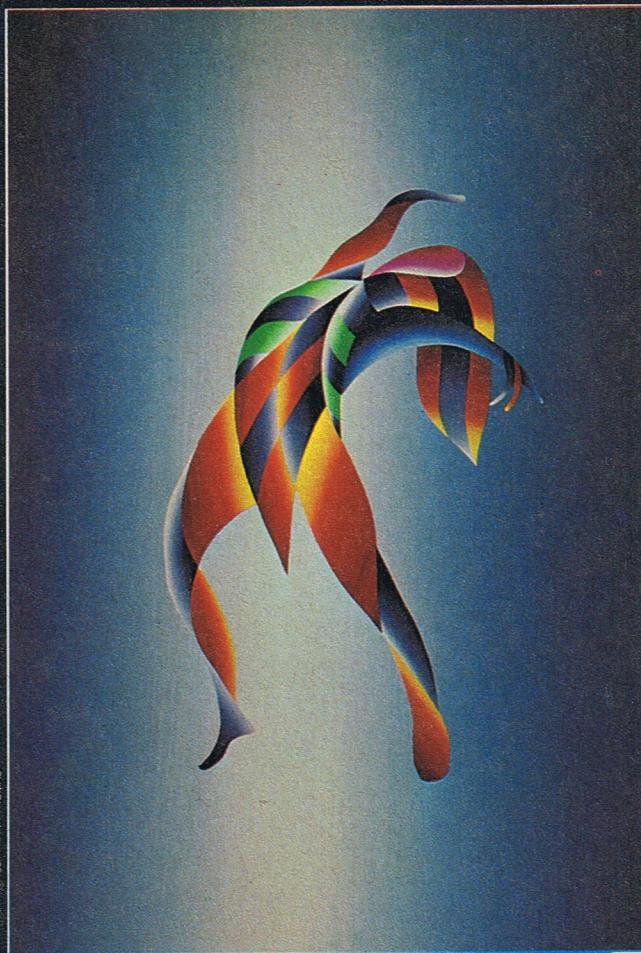
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Frank Thomas

When I lived in Burma," remembers Frank Thomas, "I took a trip with my parents to the ancient capital city. It's abandoned right now, but it's an incredible place. It's got about a million pagodas there, everything from about five feet high to 40 stories high; and inside the larger ones they have the most incredible frescos. Most of them are about 1,000 years old, and I really studied these quite a lot."

It is perhaps as a result of his travels that the 31-year-old artist has developed his vibrantly colorful style of painting. Born in Washington, D.C., Frank spent about three years in Burma, Malaysia and Thailand before returning to the U.S. to attend the University of Tennessee. He studied art rather casually during this period; however, around the age of 22, he began taking his talents more seriously. "I had a strong desire to create something," he



muses, "and it just came out in a visual form."

Thomas apparently gleans a good deal of his material from photos and artwork that he sees in magazines, translating them into his own artistic language. The painting above,

for example, is his interpretation of a photo he saw in *Newsweek* magazine which featured a woman from the cast of *Dancin'*.

However, the art featured in this issue's centerfold, entitled "Expectation," is

Frank's favorite. "That was inspired by Hokusai, the Japanese printmaker," he explains. "My sister used to live next to me, and she ordered this series of Time/Life books on art history. I was looking through their section on Japan, and there was a whole series of Hokusai's prints of Mt. Fuji. This is probably the most famous one. It's got a big wave, and then there's a railroad or a Japanese boat in the trough of the wave, and then there's a picture or an image of Mt. Fuji almost literally overcome by this wave. The wave was the thing that really inspired me. It's just that flowing motion."

"What has always fascinated me," Frank concludes, "is the fact that you can break an image up into little segments and then tie those segments all together so that they more or less flow into a form which, of course, would be the painting — using the geometrical system to project a form, or a feeling."







James Beggs

An exclusive talk with NASA's new administrator.

By TRUDY E. BELL

On July 10, 1981, James M. Beggs was sworn in at the White House as the sixth administrator of the National Aeronautics and Space Administration. Beggs had been Executive Vice President (Aerospace) and a director of General Dynamics Corporation in St. Louis, Mo. He succeeds Dr. Robert A. Frosch, who resigned on January 20, 1981 to become the first president of the American Association of Engineering Societies in New York.

Born in Pittsburgh, Pa., in 1926, Beggs graduated from the U.S. Naval Academy in 1947 and served with the Navy until 1954. In 1955 he received a master's degree from the Harvard Graduate School of Business Administration. For 13 years he was with the Westinghouse Electric Corp., and then served with NASA from 1968-1969 as Associate Administrator of the Office of Advanced Research and Technology. From 1969 to 1973 he was Under Secretary of Transportation. He went to Summa Corp. as Managing Director, Operations, and joined General Dynamics in January, 1974.

By way of general background to some of the questions: Beggs' Deputy Administrator is Dr. Hans A. Mark, who served as Secretary of the U.S. Air Force from 1979 to 1981. He had served as Under Secretary before that. A physicist and nuclear engineer, Mark joined Ames Research Center in February, 1969 and prior to that was a professor and researcher and had served as a consultant to several government agencies and held a number of university committee assignments. He was chairman of the Department of Nuclear Engineering at the

University of California at Berkeley from 1964 to 1969 and was administrator of the Berkeley Research Reactor during the same time. He received his bachelor's degree in physics from Berkeley in 1951 and a doctorate in physics from the Massachusetts Institute of Technology in 1954.

The Galileo planetary mission to Jupiter is one of the few new-start planetary exploration programs that has received funding from NASA. In its present form it consists of a two-part spacecraft, one part to go into orbit around Jupiter in the late 1980s and the other to parachute into the atmosphere of Jupiter to measure its temperature, pressure, chemical composition and other conditions at descending altitudes. The Venus Orbiting Imaging Radar (VOIR) program is an un-funded plan for the late 1980s to send a spacecraft into orbit around Venus to accurately map the topography of Venus' obscuring blanket of hot, corrosive clouds. The Halley Intercept mission is one of several plans to send a spacecraft to fly by Halley's Comet when it returns on its next once-in-76-year visit to the sun's neighborhood in 1985 and 1986. The Large Space Telescope is a project to send a giant telescope with a mirror 90 inches in diameter into orbit around Earth, to observe the universe at higher resolution and at wavelengths not accessible to Earth observatories.

Several of the recent studies that have shown that U.S. public interest in space has risen in the past several years include "American Enthusiasm for Spaceflight," by William Sims Bainbridge and Richard Wyckoff, *Analyst*, July, 1979; "Space Activists: The Movement Gains

Momentum" by Trudy E. Bell, *FUTURE LIFE* #22, November, 1980; "The Improving Socio-Political Situation of the American Space Program in the Early 1980s," by Robert D. McWilliams, presented at the Princeton Space Manufacturing Conference in May 1981. The Harris Poll was conducted in May 1981, and written up in the June 15, 1981 issue of *Aviation Week and Space Technology*.

In a recent interview with Craig Covault that was published in the July 27 issue of *Aviation Week and Space Technology*, you said that although you hoped to get some new initiatives going—and I guess one of your hopes was the Space Operations Center—your primary concern would be to get the trend of NASA funding upward. Which programs, or program areas, would be the ones you feel would receive the major priority for that upward trend? And what would you consider a satisfactory upward trend?

I don't know that I can add much more to what I've said in that interview. This agency has been coming down in both size and budget for about eight years. And the initiative that was taken with regard to the shuttle was, of course, intended to give the agency a direction over a period of years. And I guess it has done that.

At the same time that decision was taken there was a general perception in the agency that budgets would more or less remain the same in real terms. I think the budget in the 1971-72 time period when that decision was made was on the order of \$3.3 or \$3.4 billion dollars. That

budget today in current dollars, would be about \$8 billion. So we're about two billion short of just having maintained a steady state condition, which was the presumption when the shuttle was launched. A steady state condition would permit the continuance of a reasonable program of deep space exploration and also the other programs which NASA has in its statutory charter, namely the applications program and the aeronautics program.

My hope is that we can take that downward trend in real dollars and try to turn it up again and make some room for all of the initiatives or *all* of the program areas that NASA is supposed to be pursuing by reason of Congressional mandate and... by the pronouncements of several Presidents over the past 20 years as to where we are going.

The hallmark of a great nation is that the nation must be strong. And that means strong militarily as well as strong economically. But it's also my strong feeling that the hallmark of a great nation is that it continues to explore at the edge

butting to the development of both the advanced research and the applied research [in] areas, which inevitably result in improved productivity. [And] new industry and all the other good things have flowed out of the various seed programs that the government has pursued. And certainly this agency, as well as the... AEC [the now-defunct Atomic Energy Commission], have been two outstanding recent examples of that. And I think that both the President and Mr. Stockman subscribe to that.

Do you think that they subscribe to it to the point where they will actually support NASA—or begin to support it in the way that previous Administrations haven't?

They *did* support NASA. They *have* supported NASA. I think we've got to look at this thing in a very hard realistic way.

They came into town with the mandate, in their eyes and in the eyes of this administration, that the first thing that

I'm not so optimistic as to think that I can get David Stockman to yield \$2 billion overnight.

of the unknown. And unless we continue to do that, then I think we are not fulfilled in the sense that a great nation has to be fulfilled if it's to be satisfied with its role in the world.

So immediate hope would be to restore the level of funding to that original steady state level?

Well, I'm not so optimistic as to think that I can get Mr. Stockman [David Stockman, head of the federal Office of Management and Budget] to yield \$2 billion overnight.

One key element of the economics and the politics to which Reagan and Stockman subscribe is the necessity of sources of creativity for adding vitality and productivity to the nation. NASA has been cut back in exactly those areas, space science and applications and that cutting edge. What is NASA's mandate in Stockman and Reagan politics?

Well, I think they believe just that: that the advance work that is being done by the government in areas where industry will not pick it up is an appropriate role for the federal government, and that we ought to be contri-

had to be done was to get the budget back under control. Now, to do that they had to cut every program in town. And if you look at the cuts that were sustained over, let's say, the mark that the Carter Administration left with NASA and with the other agencies that do research and development, you will find that NASA got cut far less than any other agency in town. And, indeed, if you look at the mark that we had even vis-a-vis the strict R & D account of the Department of Defense—even considering the fact that the Department of Defense got large increases in hardware budgets—they did not really get a whole lot of money in the R & D account. And most of the other R & D agencies in town were cut to ribbons, so to speak, by the Stockman review.

This agency came through, relatively speaking, unscathed. What they cut out of NASA were things which, philosophically, they didn't agree with. Which is to say that they felt there were certain programs that the agency was pursuing which could be more properly pursued in private industry, or by some other segment of our society. But the mainline programs were cut hardly at all.

What about the state of planetary exploration and research?

Well, there weren't any new starts, and that's a problem. But there again, one can hardly land on all of the various and sundry social programs in town and, at the same time, grant NASA new starts. To put it another way, you can't cut food stamps and go explore the planets in the same breath.

Now, my personal view is—and this is not a reflection of the Administration view—that once the initial wave of this budget-cutting is over this coming year, then there will be some room to do some new things. And I think the Administration will very much want to do some new things. But we're going to have to tighten our belts I think, for another year, in terms of new initiatives.

What about the decade of the '80s? What about things like *Galileo*, or the Halley's Comet intercept mission, or VOIR [Venus Orbiting Imaging Radar], or any of the other programs that, to a greater or lesser extent, are on hold at the moment?

Well, *Galileo* isn't on hold. It's funded.

Isn't it affected by the unresolved inertial upper stage controversy, as to whether it would be launched by a Centaur [rocket from the shuttle], or by another type of IUS?

My understanding is that we are moving forward on the basis that Centaur will be available for the launching of *Galileo*, and that the program is moving forward on that basis. The Halley Intercept Mission is one that we are looking at. It's not an approved mission as yet, but it's one that we are looking [at] very hard to see whether we can squeeze it in some way, because of its enormous popular appeal. And certainly if the American people want something like that, they deserve it. I can't get the same enthusiasm out of the scientific community for that mission, but nevertheless, it has enormous popular appeal.

Now, the VOIR mission is an approved mission. It's not a funded one as yet, but it is in the program, and it is in the plan to be funded at some point. Beyond that, you know, the Large Space Telescope, which is a funded program, is moving forward and will have a dramatic impact, I think, once we get it up.

You mentioned what I believe is an accurate perception that the Halley Mission has a lot of popular appeal. There have been a number of assessments

made showing that American interest in space is now on an upswing, and has been, basically, since 1977. I did one on American space interest groups, and there have been others by William [Sims] Bainbridge, Robert Mc Williams, the Harris Poll and others. Does it really matter, in terms of what type of programs that NASA does, or in terms of what kinds of support NASA gets in the budget?

You bet.

How?

It translates itself into Congressional support, most importantly, and I might say that the support in the Congress has never been stronger. We have very strong backing. One can only look at what has happened. Both Houses added money to the NASA budget—not necessarily in the same place. But in a year when they are listening very closely to the popular mood, which is budget-cutting, the fact that they have added money to the NASA budget is a very strong indication that they are listening to that appeal that the space program, in general, has for the public. And I think, in addition to that, it has an effect on the Executive branch. Politicians look and listen to things like [popular appeal]. And it's very important.

Now the question for this agency has always been whether that popular appeal translates itself into votes in any significant way. And in the past, I think the general perception of political powers—that be in this country is that it did not—that it's not something that people vote for. They don't vote their desires for greater participation in space activities. But I think that it is part of a general feeling or a general perception in the public that an Administration is either doing well or poorly, depending on whether they are pursuing the kinds of advanced technology that they perceive to be desirable, important and so forth. As I said before, it is a perception of what a great nation ought to be doing. I think if the Administration has the aura of exploring the unknown in an active, aggressive way, that it *will* have a political effect.

I'd like to move a little bit from this R & D and exploration aspect of NASA to another that's certainly, in the last couple of years, come to have increasing attention and concern. The President's science advisor, George Keyworth, said that he feels that the relation between NASA and the Department of Defense requires strengthening and is a "major concern" of the Reagan Administra-

tion. And your own deputy is Hans Mark, former Secretary of the Air Force. What I'm wondering is, what does "strengthening" mean? Does it mean direct technological transfer between the two agencies? Or does it mean different priorities?

It is true that Hans Mark has just come from being Secretary of the Air Force. It is also true that, before that, he was director of the Ames Research Center of NASA—so he's tarred with both brushes.

He's probably unique.

NASA has always had a relationship with DOD, that has been, in my view, very healthy. The aeronautics program goes back to the very origins of this agency, back to the old NACA [National Advisory Committee on Aeronautics], which was really established in 1915, because the Congress and the Administration found that the United States couldn't design an effective military airplane. So they established the old

have pursued very advanced aeronautical concepts for military aircraft has had a direct fallout into the civil transport world and has enabled this nation to get a lead on the rest of the world. That's the reason we still sell three-quarters of the commercial transports in the world, even though our friends in Europe are coming fast. But I think that relationship, which perhaps has been allowed to become a little less close than it has in the past, is one of the things that Dr. Keyworth was referring to.

In addition to that, the [space] shuttle has both very large civil as well as very large military implications. By that, I mean that the military has a very direct interest in carrying their payloads in to space for all of the various things that the military has reason to be in space to do: their communications work, their various and sundry activities in the world of navigation and so on.

The relationship between the two groups, which is mostly the Air Force on the military side, and the shuttle and

It's my strong feeling that the hallmark of a great nation is that it continues to explore at the edge of the unknown.

National Advisory Committee on Aeronautics and the Langley Center to do basic and applied research on aeronautical vehicles so as to enable this nation to move forward and catch up with the rest of the world—and then to gain a position of leadership. And, indeed, when World War II came along, the major reason that this nation was well-prepared to move out in the aeronautical field with a lot of very good aircraft designs was the research work that was done by the NACA laboratories.

When NASA was created in the late '50s, they, of course inherited that. And the research in aeronautics was continued at a fairly steady state, and much of that work was translated into military aircraft of various types. Indeed, if you look at modern [fighter] airplanes, the variable-geometry wing of the F-111 and [the] F-14 came directly out of NASA research. The F-15 [and the F-16 both have] got a lot of NASA research incorporated in them: everything from the fly-by-wire system, blended wing body and so on. And that relationship between NASA and the military has been a very healthy relationship.

Not only that, the... fact that we

aeronautics program in NASA, has to be one that is very close and indeed one where there is a day-by-day exchange. I think that that, too, is something that Dr. Keyworth was referring to, and there may have been some deterioration in that relationship in the past. I don't know that that's so, but if it is so, we'll repair it. And I think that's a healthy thing for both military and for NASA, and for the country.

One last question. The U.S.S.R. plans to set up a 12-cosmonaut, permanent manned space station and I understand that it could be begun within the next six to 12 months. What do you think the reactions of this country will be when that becomes real? What would your reaction be, personally? And do you think that there would be any opportunity for opening up joint shuttle-Salyut missions, maybe when Spacelab gets operational in 1984 or 1985?

Well, let me answer the last part of the question first. The Soviets have made absolutely no overtures to us to open up any joint missions. They apparently feel that they're in the lead again in this area. And you can only read the propaganda

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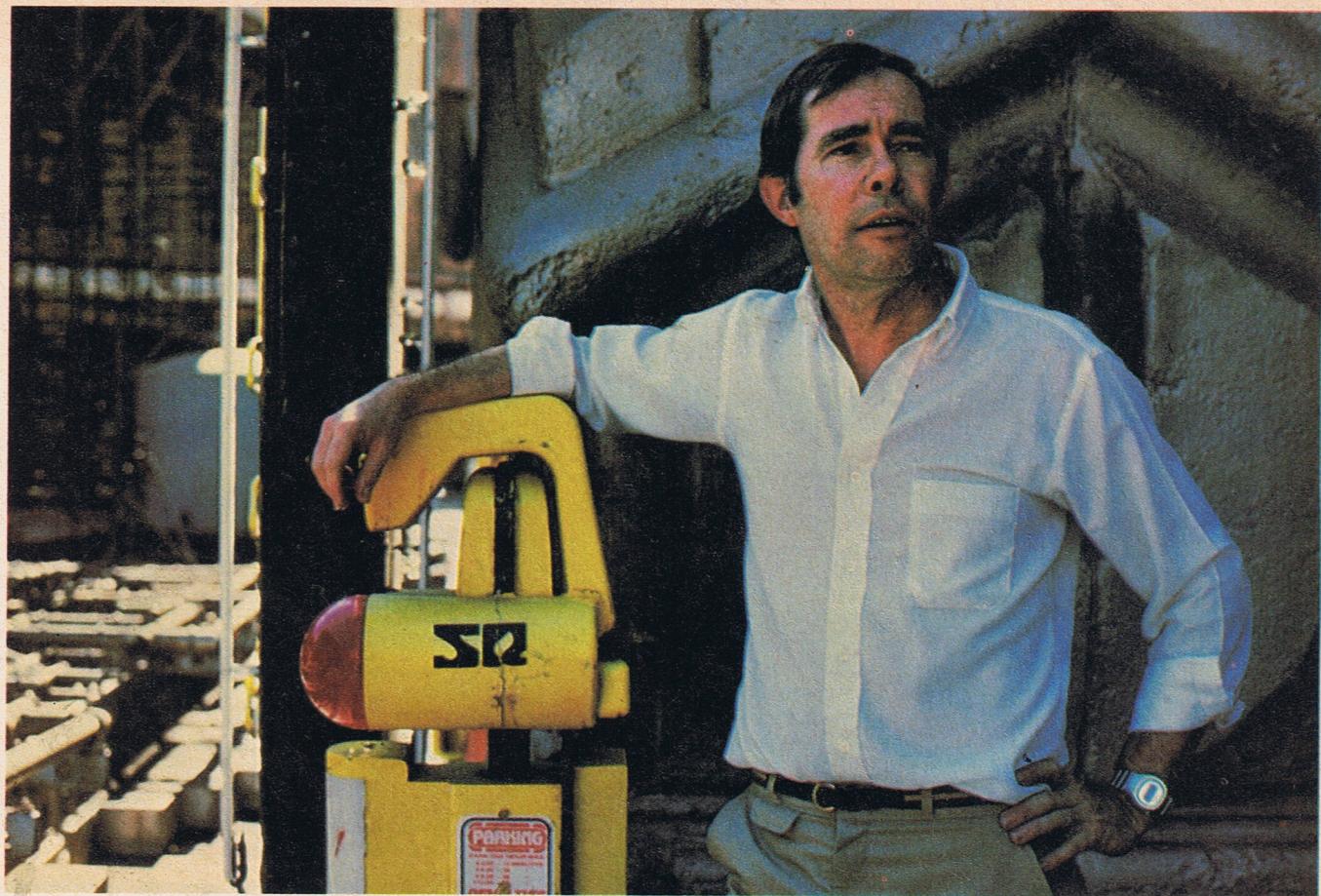
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(continued from page 43)

which emanates from their disinformation agency over there on the shuttle, to realize how much they are frightened by, or worried that we're going to overtake them and pass them again, with the shuttle. You know, all this baloney they're spewing forth about the shuttle being nothing but a military instrument—you talk about the pot calling the kettle black. Here they are running a very active ASAT [antisatellite] program, and working space as hard as they can work it in a military way, and then telling us the shuttle is intended to be primarily a military activity when, in fact, it is primarily a civil instrument. Well, it's pretty bad. But they have made no overtures in any of the discussions that I have been privy to, or have been informed of, to join us in any kind of joint activity with the shuttle. And I don't expect them to. Because, as I say, their perception is that they have moved out ahead of us for the moment. They intend to build on that.

What you say about their intent to go forward with the space station, I can't really confirm whether it is as close in as you say, but they definitely have plans, it's clear. If they move out with the space stations, an affirmative presence in space, I think it'll have a dramatic effect on the public. Once the public is knowledgeable that they are operating on a continuous basis in space, I think there will be, just as there has been in the past when the Soviets do anything, a big U.S. cry that we ought to be doing the same things they're doing, only better. I don't know whether we ought to be doing the same thing that they are doing, but as you know, both Hans [Mark] and I, at our confirmation hearings, did say that we felt that next objective should be a permanently manned station. And having said that, we now are trying to come to grips with just what that ought to be. There are several concepts that have been kicking around this agency and we're taking a hard look at all of them. But how quickly and to what degree of activity we will start on that depends on how those studies proceed.

The first thing we must do—and this must remain uppermost and first priority—is to get the shuttle operational. Because without having the shuttle in an operational mode none of the other things are possible, in my judgment. But that program must be carried through to its successful conclusion. □



Artist Syd Mead on the futuristic set of *Blade Runner*

PHOTO: LADD CO. / WARNER BROS.

BLADE RUNNER

A Retro-Deco Future

By BARBARA KRASNOFF

In an upcoming film *Blade Runner*, an SF thriller based on Phil K. Dick's *Do Androids Dream of Electric Sheep?*, director Ridley Scott will unreel his vision of a mechanistic society slowly winding down. The storyline concerns the adventures of future bounty hunter Rick Deckard, played by *Star Wars* veteran Harrison Ford, as he searches out and destroys rogue "repli-cants" (androids). In order to bring this dystopian dream to life, Scott called in futurist artist Syd Mead.

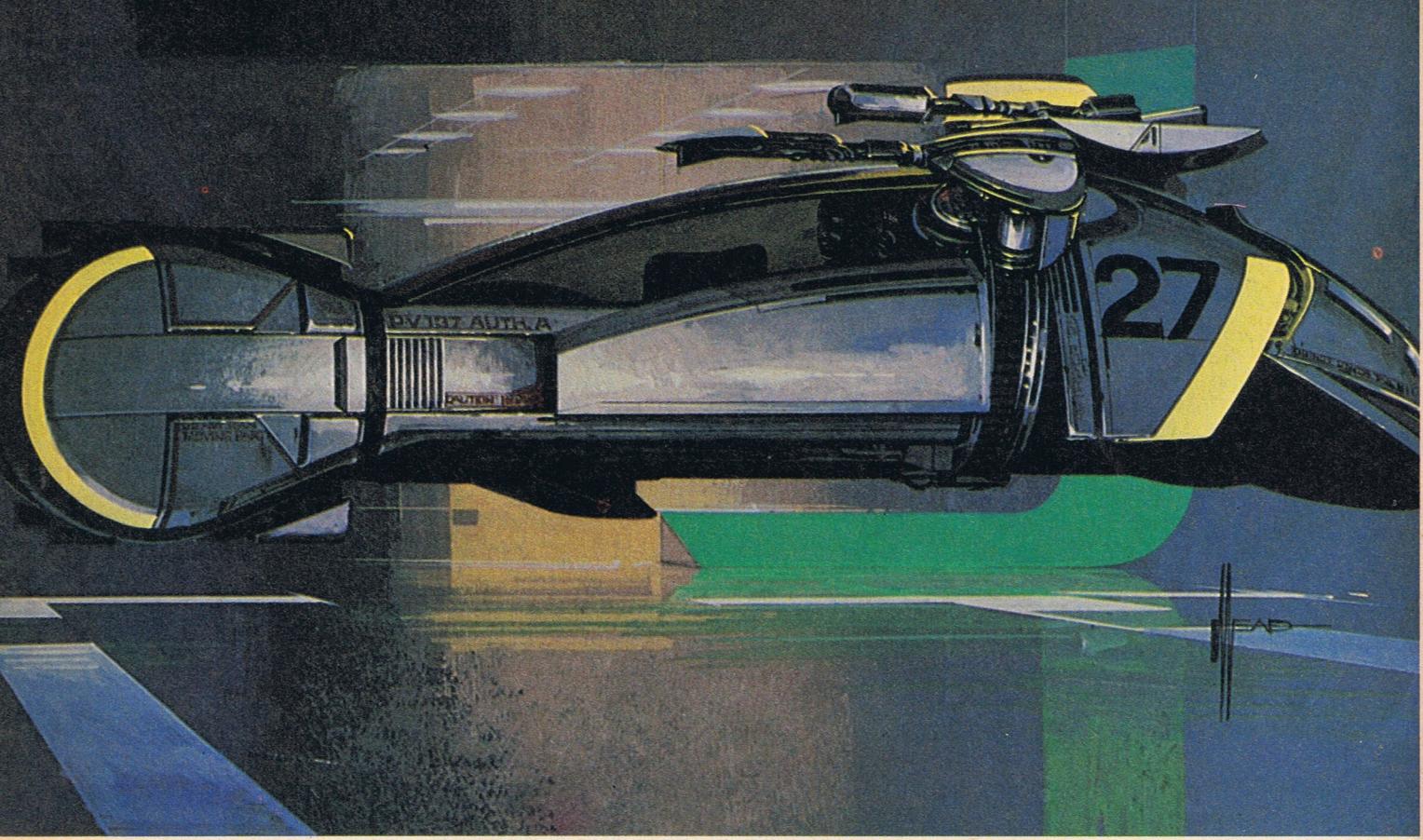
"I was originally hired to come up

with the visual design for six vehicle types," Syd explains. "I'd never really done vehicles just on a white board; I've always had a background behind them or some indication of setting—which I did. Ridley was fascinated by some of the background indications, and I gradually started to do some suggestions for street scenes and mechanical designs which would make it look like he wanted it to look."

How did Scott want it to look? "Well," Syd begins, "the story was a sort of a decaying, mechanized culture

where the consumer delivery system doesn't work too well. Everything is maybe five or six years old and you buy things to keep them working, which is the retro-fitting sort of look that the film has. We came up with a sort of word for the visual style," he grins. "Trash chic or retro-deco."

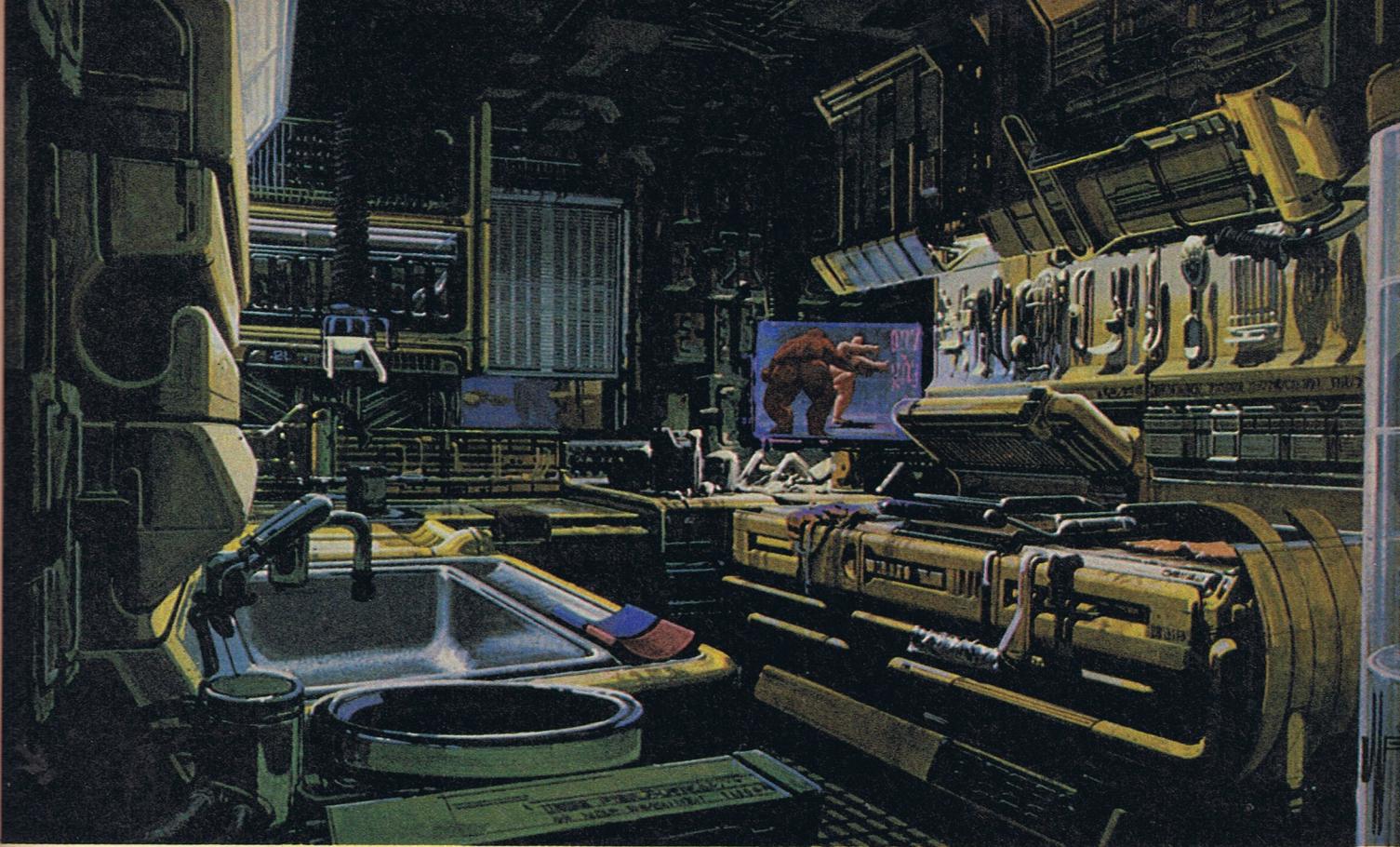
The paintings on the next two pages give some indication of the bleak world that artist Syd Mead helped create for *Blade Runner*. However, he cautions, "It's not necessarily a vision of *our* future or *the* future. It's just *a* future."



Dekard's spinner — a flying car. Several models were built of this vehicle for the film: a hollow shell for "flying" scenes, a running vehicle for ground shots, several smaller models and a full-sized interior.



A typical downtown scene circa 1995. The van on the right belongs to a character named Sebastian, whom Mead describes as "an electronic wizard, sort of a tinkerer . . . it's a jalopy of the future."



Dekard's kitchen. According to Syd Mead: "Ridley wanted sort of a crummy, macho bachelor's pad, but it had to look strange, with devices that you don't have any idea what they do."



This shopping arcade is where one of the movie's action scenes takes place. The mechanistic poses of the models are meant to accent the mechanistic, dehumanizing atmosphere of the motion picture.

AN EDGE IN MY VOICE

long on the machines that kept her alive in the biological sense, but which could not bring her back from the condition of vegetable *thing* she had become; and so finally it came to final moments when someone had to make the decision to kick out the plug. Someone made that decision.

Those ashen months of 1976, for these and other reasons, was a terrible time for me. Yet as barren of sunlight and joy as those days were, I never shared the world-pain or the absorption with thanatopsis my ex-wife had known. She would often say to me, "Why bother? What does it all mean? What's the point of living?" I would wither a little inside, because no argument suffices if the skin and bones don't understand that the answer is: we live to say "No!" to death.

Through all the days and limitlessly longer nights, I never felt my soul in the grip of the fist, never lost the humanism that keeps me warring with the rest of my species. We are one of the universe's noblest experiments; we have a right to be here, I've heard; and if we struggle long enough against the forces of ignorance and mischievousness that bedevil us, we will be worthy of that place in the universe. I believed that, continue to believe it, and only *once* during the monstrous period was my faith in the nobility of the human race shaken.

A month after my marriage became a portion for foxes, two months after my mother finally found the trail opened for her reunion with my father, I experienced the lowest moments I've ever known in my consideration of those with whom I share common heritage. On December 22, 1976—for the first and I sincerely hope only time—I was dashed to despair in the sure and certain knowledge that we are an ignoble, utterly vile form of life, unfit to steal space from weeds and slugs and the plankton in the sea.

That moment came in a motion picture theater, and I, who fear almost nothing, was frightened. Not at what was on the screen: at the audience around me. Fellow human beings, a stray and unspecific wad of eyes and open sensory equipment, common flesh and ordinary intellects. So petrified me with horror that I had to hold myself back from screaming and fleeing. I wanted to hide.

I can't get over it, even now: *I wanted to hide*. I was more scared than I'd ever been, before or since.

Pause. Deep breath. Quell the memory. Force back the abreaction. Stop the shiver as it climbs.

On that Wednesday night I was escaping my life. I got in the old dirty Camaro and drove into the San Fernando Valley just over the hill from my house. Down there in the Valley is not Hollywood, it is not Brentwood or Westwood, it is barely Los Angeles. In many ways it is a suburb of Columbus, Ohio. As writer Louise Farr has said, it is the edge of the American Dream that bindlestiffs and bus-riders have come to seek where the sidewalks are made of gold. Or at least partially inlaid with bronze stars. But it is Country, in the way Fort Worth will always be Country, no matter how urbane and cosmopolitan Dallas becomes. It is tract homes and fast food and the Common Man keeping barefoot and pregnant the Common Woman.

Oh, there are fine shops and big homes—in Woodland Hills and the newer 850-to-million-five estates—there are nonpareil French restaurants like Aux Delices and Mon Grenier; there are pseudo-hip *boîtes* like Yellowfingers and L'Express, but every once in a while they get the French syntax wrong and wind up with names like Le Hot Club. Nonetheless, it ain't all no-necks and polyester crotches. It is just, like where you live, The Valley. As close to the American Dream as Common and *average* may ever hope to get.

I drove out, drove around, could not escape myself. And decided to take in a movie. Any movie. Didn't give a damn what or which.

In Tarzana, out along Ventura Boulevard, near the big tree under which I am told Edgar Rice Burroughs lies buried, in the bedroom community named after his greatest creation, there is a multiple-cinema like the thousands thrown up in every American city these past decades. Cinema I—Cinema II—Cinema III—Cinema IV they call themselves, these windowless, airless cubicles. They are not theaters. Theaters had spacious lobbies and balconies; they had cut glass chandeliers and ushers with flashlights; they had an authoritarian manager in an impeccable tuxedo to whom you could complain when the noisy schmucks be-

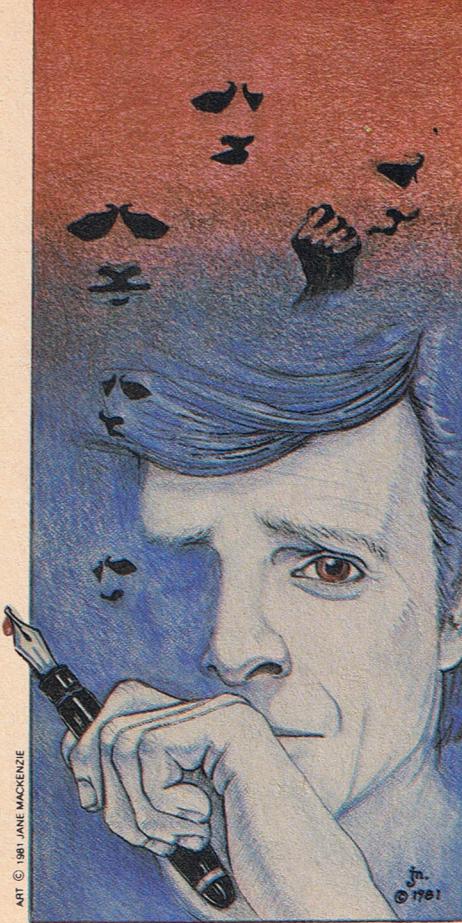
Once upon a time not too long ago I was married to a young woman whose every waking moment was underlain by a preoccupation with thanatopsis.

Perhaps it was only *Weltshmerz*; but I ruminate about her occasionally, and I'm more and more inclined to believe it was genuine thanatopsis.

I won't make you go to the dictionary. *Weltshmerz* is one of those words that sums up in German what would take paragraphs to illustrate in English. It means sorrow which one feels and accepts as his/her necessary portion in life; sentimental pessimism; literally, world-pain. *Thanatopsis* comes from the Greek personification of death, Thanatos. Like thanatophobia, it is a view or contemplation of death that transcends mere mortal awareness that we all come to an end in darkness.

I lived with her for a year, and was married to her for somewhat less than another year; and on November 20, 1976, I sent her away and divorced her when I finally realized, for reasons I will not go into here, that I could not trust her. It was the culmination of a chain of events that I number among the most debilitating in my variegated life.

One month earlier, on October 8, 1976, my mother died, after a long and dehumanizing illness. She had spent too



hind you wouldn't shut up; they had a candy counter with freshly popped popcorn that got real butter slathered over it, not some artificial crankcase drainage that had never seen the inside of a cow. They were theaters, not these little boxes which, if they had handles, would be coffins. In Tarzana they have caused to be thrown up a six-box edifice called Theeeeeee Movies of Tarzana.

I didn't care what I saw, just as long as I hadn't seen it before. Every screening room had a double feature. I picked the one that had two films I hadn't heard much about. I don't remember what the A film was, but the second movie, the B, was one that had been around for a few months, that I'd missed.

It was called *The Omen*. You may know of this film.

It was crowded for a Wednesday night and the lights were up as I wandered down the single aisle to find a seat. *The Omen* would start in a few minutes.

I gauged the audience. I've come to hate seeing films in ordinary theaters since the advent of television. People talk. Not at the screen, an occasional *bon mot* as response to something silly in the plot or a flawed performance, but to each other. Not *sotto voce*, not whispered, not subdued, with the understanding that there is *something going on here*, but at the top of their lungs, as if they were yelling in to someone in the kitchen to fetch them a fresh Coors. They are unable to separate reality in a theater from fantasy in their TV-saturated home. They babble continuously, they ask moronic questions of each other, they make it impossible to enjoy a motion picture. It is the great dolt audience, wrenching from the succoring flicker of the glass teat, forced out into this Halfway House between television stupor and the real world: not yet fully awake, merely perambulated into another setting where the alpha state can be reinduced. I looked around at my fellow filmgoers. Not much different from the crowd you last shared a Saturday Night at the Movies with.

I do not think I malign them too much by characterizing them as eminently average. From their behavior, from the mounds of filth and empty junk food containers I had to kick aside to get to my seat, from the stickiness of my shoes from the spilled sugar-water, from the beetled brows and pig-like eyes, the feet up on the backs of seats in front of them,



Funhouse

PHOTO © 1980 UNIVERSAL CITY STUDIOS, INC.

from the oceanic sound of chewing gum, I do not think I demean them much by perceiving them as creeps, meatheads, clods, fruitcakes, nincompoops, amoeba-brains, yoyos, yipyops, kadodies and clodhoppers. But then, the garbage dump smell of bad breath, redolent armpits, decaying skin bacteria and farts mixed with bad grass always gives me a headache and puts me in one of my foulest Elitist humors.

Nonetheless, I was there, the film was to start in a few minutes, and I was trying to escape (in the worst possible *situs*) the world. So I took a seat next to a young man and his date, a young woman. I gave them the benefit of the doubt: a young *man* and a young *woman*. I was shortly to learn that I had misjudged them. Actually: *were-things* passing for human.

I will describe them physically.

The young woman was vibrating against the membrane of her 20s. Gum moving in the mouth. Shortish. Ordinary in every esthetic consideration. Just a female person, holding the right hand of the young man who sat to my right. What distinguishes her most in memory is that she was with *him*.

Ah. *Him*.

There is a sort of young man, never older than 25, that I occasionally encoun-

ter at college lectures. The somatotype is one you'll recognize. Large, soft, no straight lines, very rounded. A lover of carbohydrates. Pale. An overgrown Pillsbury doughboy. Weak mouth. Alert. Very sensitive. And I usually have to confront this type when I've done a number on Barbra Streisand, with whom I've had a number of path-crossings in my life, and whom I do not like a lot.

So when I've mentioned Ms. Streisand, and have expressed my opinion of her, one of these great soft things leaps up in the audience and, usually with tears in his eyes, hysterically reads me the riot act. "Barbra is glorious! Barbra is a star! What do you know about anything? You're just jealous of her!" Followed by *exeunt trembly*.

(God knows how much I envy her. She can wear a cloche and wedgies so much *better* than I. Don't shoot the shwans.)

Beside me sat one of those. He looked like Lenny in Steinbeck's *Of Mice and Men*. Probably not all there: several bricks short of a load: only 1.6 oars in the water. Big, soft, holding her hand.

Enough. Let me get directly to the moment.

This film, *The Omen*, is a textbook example of what we mean when we

speak of gratuitous violence. That is, violence escalated visually beyond any value to plot advancement or simple good taste. That which makes your stomach lift and your eyes look away. Not the simple ballet of death one accepts in *Straw Dogs* or *The Wild Bunch* or *Alien* or *Bonnie and Clyde*: I've seen death close up a few times. Those films are okay.

The whining passengers of the *Poseidon*; the downy-faced aviator on his first recon flight with Gable or Robert Taylor; the PFC who stands up in the Bataan jungle to yell to his rifle squad, "Hey, it's all clear, no more snipers!" Pee-ing! Bullet through the brain. We know poor David Warner is about to get shitcanned in some earsplitting way.

As the group of which Warner is a

way of the truck... Warner... glass... ohmigod! we know what's going to happen because the intercuts are harder, closer together, the music begins to crescendo... the impediment stops the truck... the wheels of the truck smash into it... the truck stops short... the glass wrenches loose and zips off the rear of the truck... Warner seeing the glass coming toward him...

Now we know he's going to get hit by the glass.

And because we're trained to drive instantly to the most morbid escalation of the death-equation, we suspect he'll be decapitated. And that's the point to which violence is at least tolerable, acceptable, required by the plot.

But.

Little Dickie Donner, famed far and wide as the director of the television kidie show *The Banana Splits* and a movie about a superhero, charming Richard Donner directs the scene like this (remember, you're sitting in a theater all unaware of what's coming at you):

Intercuts. The glass slicing through the air. David Warner's face registering terror as he sees it coming. His eyes starting from his head. His mouth open in an animal scream of horror. The faces of the other actors distorted in ghastly expectation of the impact. Glass! Warner! Screams! Closeup on the glass slicing into Warner's neck. Blood spurts

No, *The Omen* is another can of worms.

And the moment came like this:

There is a scene in which David Warner gets his head cut off by a sheet of plate glass. We have been set up for this scene in a number of ways, so we will feel trepidation and mounting tension. Warner has evinced that sweaty, doomed attitude we have come to know through years of moviegoing as endemic to those the plot demands get wasted.

member rushes through the street of some Algerian-style city (it's been over five years since I saw the film and detailed specifics of plot are blurred), we get artful intercuts by director Dickie Donner of Warner's sweaty, crazed face... a truck or wagon or somesuch with a large sheet of plate glass lying flat on the bed, protruding off the rear of the vehicle... Warner rushing... the truck trundling... the glass looking ominously ready... an impediment in the



Mother's Day

across the glass. The head rolls onto the glass. Glass and body carried backward to smash against a wall. Glass splintering.

Okay, we think, horrible. That's it, though. It's over.

Wrong, and wrong.

Now the head rolls down the glass, draining blood from dangling cords and emptying carotid artery. Blood smears on glass in long slimy streaks.

Enough!

The head bounces off the glass, hits the cobblestones, rolls.

Enough!

Camera follows the head bouncing down the street.

Enough! Enough already!

The head rolls into a corner.

Enough! God, cut me a break here!

The head comes to a stop as the camera comes in on the final spurt of blood, the face contorted in horror, the eyelids still flickering...

And here is the ultimate ghastliness of that moment, close to Christmas of 1976. Not on the screen. In the theater.

The audience was applauding wildly.

They were, God help them, laughing!!

And beside me, that great soft average American boy and girl, fingers twined tightly, were pounding their fists on his knee. From him: moaning bursts of sound, as if he were coming. From her: sharp little expletives of pleasure, as if she were coming.

Rooted, unmoving, my hair tingling at the base of my scalp, memorable fear overwhelming me, I sat there in disbelief and dismay. What kind of lives could these people live? What awful hatred for the rest of the human race did they harbor? What black pools of emotion had been tapped to draw such a response? The character David Warner played was not a villain, so they couldn't be excused or understood on the basis of catharsis... that no-less-bestial but at least explicable release of applause and whistling when the Arch-Fiend or the Renegade White Man or the Psychopathic Terrorist gets blown away. No, this was a high from the violence, from the protracted, adoring closeups of blood and horror.

This was America experiencing "entertainment."

* * *

I can't remember the rest of the film. I'm not sure I actually stayed to the end. I know I didn't see the feature film I'd

come to see. I may have stumbled up the aisle and into the night, decaying inside from the death of my mother, the breakup of my marriage, loneliness, sorrow... and the evil rite I had just sat through. But now, five years later, I recall that moment as the absolutely lowest point I've ever reached in loathing of my species. I could not even fantasize wiping them off the face of the Earth. That would have been to join with them in their unholy appreciation of the senselessly violent. I just wanted to be away!

Now, five years later, I see the twisted path stretching from that night of monstrous perception to an omnipresent mode in current movies.

In the phrase credited to writer-interviewer Mick Garris, *knife-kill movies*.

How many have you seen?

Texas Chain Saw Massacre, Prom Night, He Knows You're Alone, Don't Answer The Phone, Dressed to Kill, When a Stranger Calls, Motel Hell, Silent Scream, Blood Beach, My Bloody Valentine, Friday the 13th, The Omen II, Mother's Day, Zombie, Eyes of a Stranger, The Boogey Man, New Year's Evil, Maniac, Terror Train, Humanoids from the Deep and, yes, I'm sorry to include this for those of you who adored it, *The Howling*.

How many knife-kills have you sat through?

More important: ask yourself *why* you went to some of these films, when you knew in advance how twisted, how anti-human, how sexist, how degenerate they promised to be?

Are *you* a great soft average American boy or girl? Did *you* come when the sharp stick gouged out the eyes? Did *you* applaud when the heads were sawed off? Did *you* gasp with pleasure at the special effects when the straight razor sliced and the blood splattered the camera lens?

Are you still deluding yourself that you're sane?

* * *

Though there are exceptions the apologists will always cite, the bulk of the violence—total, psychopathic, sudden and seemingly the only reason for making these films—is directed against women. Females burned alive, hacked to ribbons, staked out and suffocated slowly, their limbs taken off with axes, chain saws, guillotines, threshing machines, the parts nailed up for display. The deification of the madness Jack the Ripper visited on pathetic tarts in Spitalfields in 1888.

As a man who hit a woman once in his life and swore never to do it again, I reel back from these films where hatred and brutalization of women is the governing force of plot. I'll admit it, I cannot watch



Raiders of the Lost Ark

these films. I get physically ill.

But they must be drawing an audience. More and more get made each season. Saturation advertising on television pulls you to them. They make money. And money begets money; and the begetting sends even greater numbers of minimally talented filmmakers to the form. They proliferate.

Even so, their revulsion at these films (which they patronize like crazy) is the healthiest thing about such movies. Everything else, from motivation for making them to artistic values, drips with perversion.

I have a theory, of course. Don't I always.

These are not, to me, films of terror or

scared you, held you helpless in the thrall of fear, gave you memories that chilled not sickened you. From *Snow White and the Seven Dwarfs* to *The Parrallax View* and *Carrie*.

It was always the scenes leading up to the violence that you remember. You needn't watch the death... you had been wrung dry before it ever happened.

What do I consider a terrifying scene. Here, try this:

* * *

Chill beneath a cadaverously-gray autumn sky, the tiny New Mexico town. That slate moment in the seasons when everything begins to grow dark. The epileptic scratching of fallen leaves hurled along sidewalks. Mad sounds from the hills. Cold. And something else:

A leopard, escaped, is loose in the town.

Chill beneath a crawling terror of spotted death in the night, the tiny New Mexico town. That thick red moment in the fears of small people when everything explodes in the black flow of blood. A deep-throated growl from a filthy alley. Cold.

A mother, preoccupied with her cooking, tells her small daughter to go down the street to the bakery, get flour for father's dinner bread. The child shows a moment of fear... the animal they haven't found yet...

The mother insists, it's only a half block to the bakery. Put on a shawl and go get that flour, your father will be home soon. The child goes. Hurrying back up the street, the sack of flour held close to her, the street empty and filling with darkness, ink presses down the sky, the child looks around, and hurries. A cough in the blackness behind her. A cough, deep in a throat that never formed human sounds.

The child's eyes widen in panic. She begins to hurry. Her footsteps quicken. The sound of padding behind her. Feet begin to run. Focus on darkness and the sound of rapid movement. The child. The rushing.

To the wooden door of the house. The door is locked. The child pinned against the night, with the furred sound of agony rushing toward her on the wind.

Inside, the mother, still kitchened, waiting. The sound of the child outside, panic and bubbles of hysteria in the voice, Mommy open the door the leopard is after me!

The mother's face assumes the ages-

And the sickness spreads.

You wonder why the Moral Majority has some coin with otherwise rational Americans? It is because they fasten on festering sores like the spate of knife-kill films and they argue from the solitary to the general: moral decay, rampant violence, rotting social values. Joining with these latter-day Puritans on a single issue, though one may despise what they're *really* trying to do, is the downfall of all liberals.

suspense in the time-honored sense of such genre definitions. *The Thirty-Nine Steps*, *North By Northwest* and *Gaslight* are classics of suspense. *Frankenstein*, *The Wolf Man* and *Alien* are classics of terror. The lists are copious. *Rosemary's Baby*, *Knife in the Water*, *Repulsion*, *The Haunting*, *The Innocents* (from Henry James's *Turn of the Screw*), *Psycho*, *The Birds*, *Dr. Jekyll and Mr. Hyde*, *Dead of Night*. Add your own. You know which ones they were that



Friday the 13th

old expression of harrassed parenthood. Hands on hips, she turns to the door, you're always lying, telling fibs, making up stories, how many times have I told you lying will—

 Mommy! Open the door!

 You'll stay out there till you learn to stop lying!

Mommy! Mom—

 Something gigantic hits the door with a crash. The door bows inward, and a mist of flour explodes through the cracks, sifts into the room. The mother's eyes grow huge, she stares at the door. A thick black stream, moving very slowly, seeps under the door.

 Madness crawls up behind our eyes, the mother's eyes, and we sink into a pit of blind emptiness...

 ...from which we emerge to examine the nature of terror in the motion picture. Fear as the masters of the film form have showed it to us, and fear as the screen has recently depicted it, with explicit vomitous detail, with perverted murder escalated from awfulness to awfulness. Having seen the deaths of dozens, one is spiraled upward to accept the closeup deaths of hundreds. Knives are not enough, they're old hat. Razors are not enough, that's been done. To death. Meathooks are not enough, that's a cliche. Has anyone squeezed that bag of blood called the human body in a car crusher? Yeah, well, we can't use that. How about a paper pulping machine, a blast furnace, a rubber stamper, a meatgrinder, a Cuisinart? What's

more ghastly than the last piece of shit? Acid? Rat poison? If we use acid or rat poison we have to show the victim writing, vomiting, tearing her own throat out, the burns, the drool. Hey, is there something that'll explode the eyeballs right out of their sockets? Then we can show the raw red pulpy brain behind the empty holes. Now that's fresh, new, inventive, state of the art. Maybe we can call it *Scanners*.

 Or *Outland*.

* * *

 The scene just described, a scene shot for the small theater screen, in black and white, with a minimum of production values, with unknown actors, shot with misdirection (in the sense of that word as magicians use it) and subtlety is from a little remembered 1943 RKO Radio Picture, *The Leopard Man*, based on a brilliant Cornell Woolrich thriller, *Black Alibi* (1942). I offer it as a fine example of cinema terror in its most natural, unsullied incarnation, from the *oeuvre* of Val Lewton. To students of terror in films, the name Val Lewton will be familiar. Had I wanted to be less precise but more chic, I'd have cited the early Dassin or Hitchcock.

 But as a more reliable barometer of the centigrades to which artful horror can chill a filmgoer, I find no equal to what Lewton produced in merely eight films between 1942 and 1947, with budgets so ludicrous, achievements so startling, and studio intentions so base,

that they stand as some sort of landmark for anyone venturing into the genre, whether a John Carpenter or a Brian De Palma.

 Using the foregoing as yardstick, and comparing the knife-kill flicks against them, I submit what we're getting these days are not films of terror or suspense or even horror. They are (and here's my theory) blatant reactionary responses to the feminist movement in America.

 Surely there are no great truths being propounded in these films, no subtext that enriches us with apocryphal insight, no subtle characterizations that illuminate the dark night of the soul, no messages for our times...unless the message is that every other person you pass is a deranged killer waiting for you to turn your back so he or she can cut your throat.

 No, I've convinced myself, even if you may have trouble with the theory, that this seemingly endless spate of films in which women are slaughtered *en masse*, in the most disgusting, wrenching ways a diseased mind can conceive them, is a pandering to the fear in most men that women are "out to get them."

 In a nation where John Wayne remains the symbol of what a *man* is, the idea of strong women having intellectual and sexual lives more vigorous than their own is anathema. I submit the men who go to see these films *enjoy* the idea of women being eviscerated and dismembered in this way. They get off on it. In their nasty little secret heart-of-hearts they're saying, "That'll serve the bitch right!"

 The audiences that go to these films, that queue up to wait an hour for their dollop of deadly mayhem, are sociopaths who don't know it. Beyond that, and I have no way to prove it, I think these films serve no purgative, cathartic end. They merely boil the blood in the potential rapist, the potential stalker, the potential knife-killer. They are twisted dreams from the darkest pit in each of us, the stuff against which we fight to maintain ourselves as decent human beings.

 I leave it at that. For the moment.

 I expect to get mail on this. I look forward to it.

 I will respond in these columns.

 Because: it has to stop.

EDITOR'S NOTE: Mr. Ellison has been given a free hand to express his opinions. If you don't like what he says, it's not our fault. If you really love his column, we'll take full responsibility. Publishing is funny like that. The content is copyrighted © 1981 by The Kilimanjaro Corporation.



Terror Train

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Tenn-Tom: Pork Barrel Part II

The government, like the Lord, works in strange and wondrous ways. Since early spring we've watched and listened while the federal budget folks scolded us for spending too much of *our* tax money. It would have to stop, they said, or campaign promises about balanced budgets would have to be broken. Bit by bit, program by program, the federal budget belt tightened. They cut funds for food stamps, youth employment, Medicaid and a host of other "wasteful" social programs. Meanwhile, Congress was about to approve \$189 million for continued work on the Tennessee-Tombigbee Waterway. Stockman's raiders must have overlooked this one, for if there were ever an example of waste, "Tenn-Tom" is it. As *The New York Times* said in a critical editorial, "An Administration and Congress asking everyone to make do with less have no right to cling to such blatant pork barrels."

(Before you read any further you should run and get a dictionary and a map of the United States. First, look up pork barrel; then open the map to Mississippi and Alabama and find the Tennessee River, in northern Alabama.)

The Tennessee-Tombigbee Waterway is another project of the U.S. Army Corps of Engineers, the agency that has managed to dam up just about every free-flowing river in this country. (The Corps also recently recommended that the feds spend \$22 billion over the next 30 years on their various waterways.) What they propose in this case—and it took 25 years before they could get any money to start digging—is to link the Tennessee River with an existing waterway, the Warrior River system, that leads south to the Tombigbee River and then to the Gulf of Mexico (now you can look *that* up on your map). For a measly \$3 billion, though it was originally price-tagged at \$300 million in 1969, the Corps would give us a 232-miles river/canal, proposed as a shortcut for barge traffic that would otherwise use the longer, but generally parallel, Mississippi River (take a look at the map again). Proponents have suggested that the waterway would become a vital link for coal mines

in the Midwest—Illinois, southwestern Indiana, Kentucky—and then shipped to overseas markets. Other benefits, Tenn-Tom supporters said, would be the attraction of industry and the general bolstering of the region's economy. The project is now 55 percent complete, and most of these justifications have not proved themselves.

To date, the waterway is being stalled by the U.S. Court of Appeals which last July reversed a federal district court's decision and directed that a supplemental environmental impact statement on the project be prepared. That action held up Congress' hard-won appropriation of the \$189 million. But more importantly, the Court's decision brought to the forefront the scam that the Army Corps of Engineers has been pulling on the taxpayers with Tenn-Tom, the largest public works project currently underway.

The Court concluded, on two key legal and economic requirements, that the Corps did not follow the law. It seems that the Corps has set the interest rate (for determining the benefit-cost ratio) far below the proper limit, thereby conveniently understating the true costs and over-stating the waterway's benefits. Secondly, the Court found that the legally required "local assurances" of financial support had never been made. The Court further criticized the Corps for the lack of proper environmental impact assessments, which had greatly increased during the decade of construction. Again, these actions by the Corps are *against the law*.

Then came an eight-page report from the Library of Congress's Congressional Research Service, generally refuting many of the original justifications for constructing Tenn-Tom. The Corps had promised that the movement of coal along the waterway alone made the project worthwhile. However, the CRS study states that Appalachian coal, the type that would be barged down the Tenn-Tom and sold overseas, is no longer in demand. European countries are buying instead low-sulphur coal that does not require use of expensive scrubbers to clean the coal. Furthermore, the

study says that coal industry reports show that no major expansion of coal mining is planned in the areas that are supposed to benefit from the waterway. It also seems that size limitations on the barges designed to travel down the Tenn-Tom make it more profitable for coal shippers to use the longer but more navigable Ohio and Mississippi Rivers just to the west. Lastly, the report determines that recent improvements in Eastern railroads will create stiff competition to the Tenn-Tom. In essence, it looks like it would be a waste of time and money to ship coal along this new route.

And, of course, there are serious environmental impacts involved in a project of this size. Creation of the waterway would destroy significant portions of the Tombigbee River and create a series of reservoirs of poor water quality. Additionally, the project would require 100,000 acres of forest, farmland and wildlife habitat.

Recommendations have been made that the project be moth-balled before it has a chance to waste even more of *our* tight money. The portion that has thus been completed could be used to possibly recoup some of the money already squandered. But, pork barrel projects being what they are, this probably won't happen. The project has some powerful supporters on the Appropriations Committee. And as we saw with the equally wasteful Tellico Dam pork barrel in Tennessee last year (see FUTURE LIFE #16), powerful Congressmen are what make government ways strange and wondrous.

The next time you read in the papers about some other social program being slashed from the budget, you might consider writing a letter to your Congressman, asking him how he can justify spending \$189 million in one year for a useless waterway. You might remind him of something that one of his previous colleagues, former Congressional representative David Stockman, said about Tenn-Tom in days gone by. If Congress pays for marginal projects like Tenn-Tom, he suggested, it ought to "go whole hog and build a pyramid in every state."

SOUNDTRACK SPECTACULAR



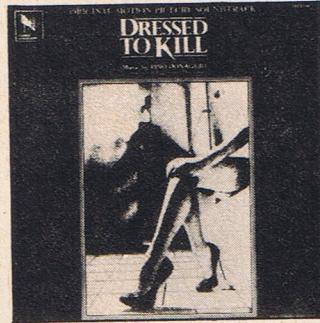
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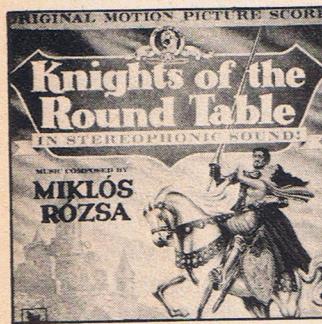
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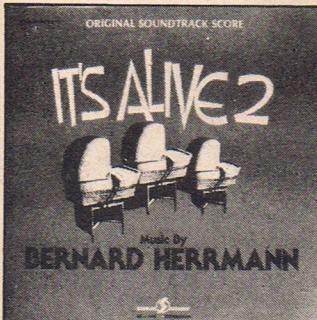
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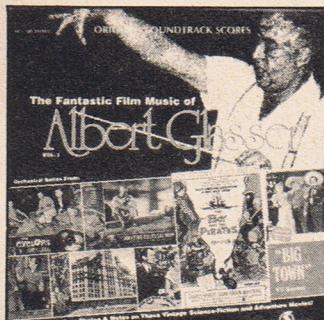
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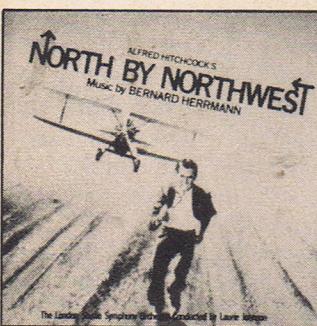
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The Alien World of WAYNE BARLOWE

By BOB WOODS

"I've always liked having ideas that might be alien to everyone else." One look at his art and you can tell that Wayne Barlowe means what he says. Few science fiction illustrators have been able to translate their alien fantasies into such captivating renderings, as evidenced in Wayne's highly successful book *Barlowe's Guide to Extraterrestrials*. But beneath the surface of the otherworldly texture of Wayne's art lives a spirit that goes far beyond what so pleasantly meets the eye.

Unlike many of today's premiere SF artists, Wayne didn't spend his childhood with his head buried in a comic book or watching the classic SF movies of the '50s. In fact, he wasn't even born until 1958. Instead, Wayne owes much of his early background and influence to his parents, Sy and Dorothea, a renowned team of natural history illustrators. Their animal drawings have been featured by a variety of publishers, particularly in Western Publishing's popular Golden series of wildlife guidebooks. Not only did his mother and father influence him in his general appreciation for art and illustration, but they instilled a dedication to scientific and anatomical accuracy that has carried itself over so poignantly in his work. Indeed, his extraterrestrial guide strikes an alien parallel to John James Audubon's definitive wildlife drawings. Wayne's precise attention to each alien's habits, environment and culture reflect his unabiding appreciation and understanding of biology, zoology, ecology, climatology and anatomy. Speaking of the intriguing dichotomy between Wayne's and his parents' work, the Brothers Hildebrandt wrote: "The elder Barlowes paint animals the way they are;

Wayne paints animals that never were and makes us believe they could be."

Wayne's artistic abilities were nurtured with his enrollment, at the age of 11, at New York's famous Art Students League, where he studied for a couple of years. He also, as he says, "went through your typical public school bologna." He graduated early and was easily accepted at Cooper Union art institute. He spent two years there, "getting, basically, philosophies from them more than anything else, because they were not as receptive to illustration as they could have been."

Overall, Barlowe considers much of this early training as superfluous since even then, he admits, he knew exactly where he wanted to go with his art. "I wanted to do paperback art. It was my early dream." This ambition probably also had a lot to do with his appreciation of science fiction ("I had been reading science fiction since I could read.") and his high regard for artists like Frank Frazetta, John Berkey and Vincent Di Fate.

So here was this relatively young man, equipped with classic art training, a keen scientific sense, a true love for SF and a conviction that he wanted to illustrate paperback covers. It was an unusual conglomeration of talent that did not always fit into the growing market of SF paperbacks. "I was never too thrilled about taking stories and doing conjectural covers for them. I would always want to take my own storyline and do a painting around it. So my portfolio was growing with pieces that were things that I wanted to do."

Nevertheless, Wayne's portfolio garnered considerable attention—and eventually cover assignments—from SF pub-

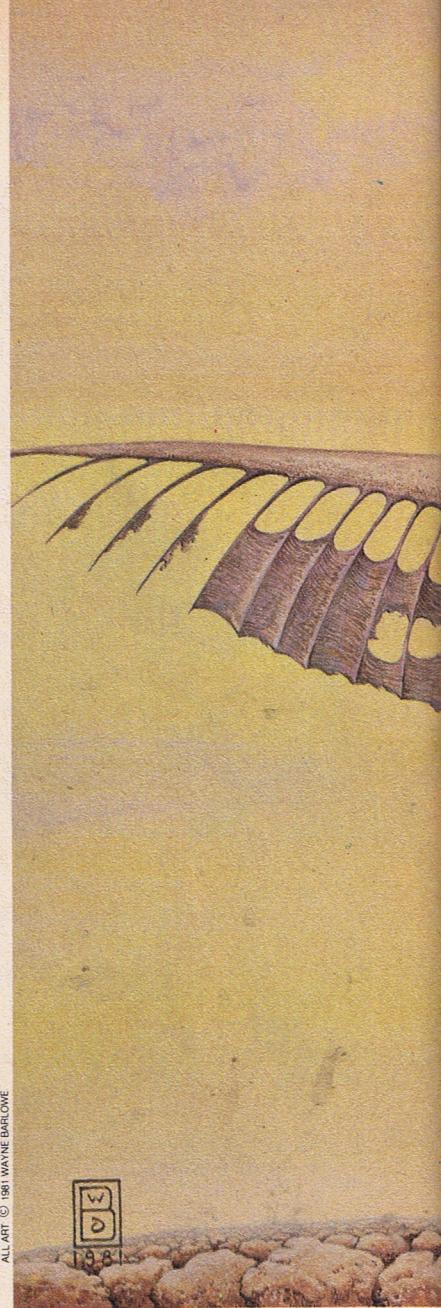
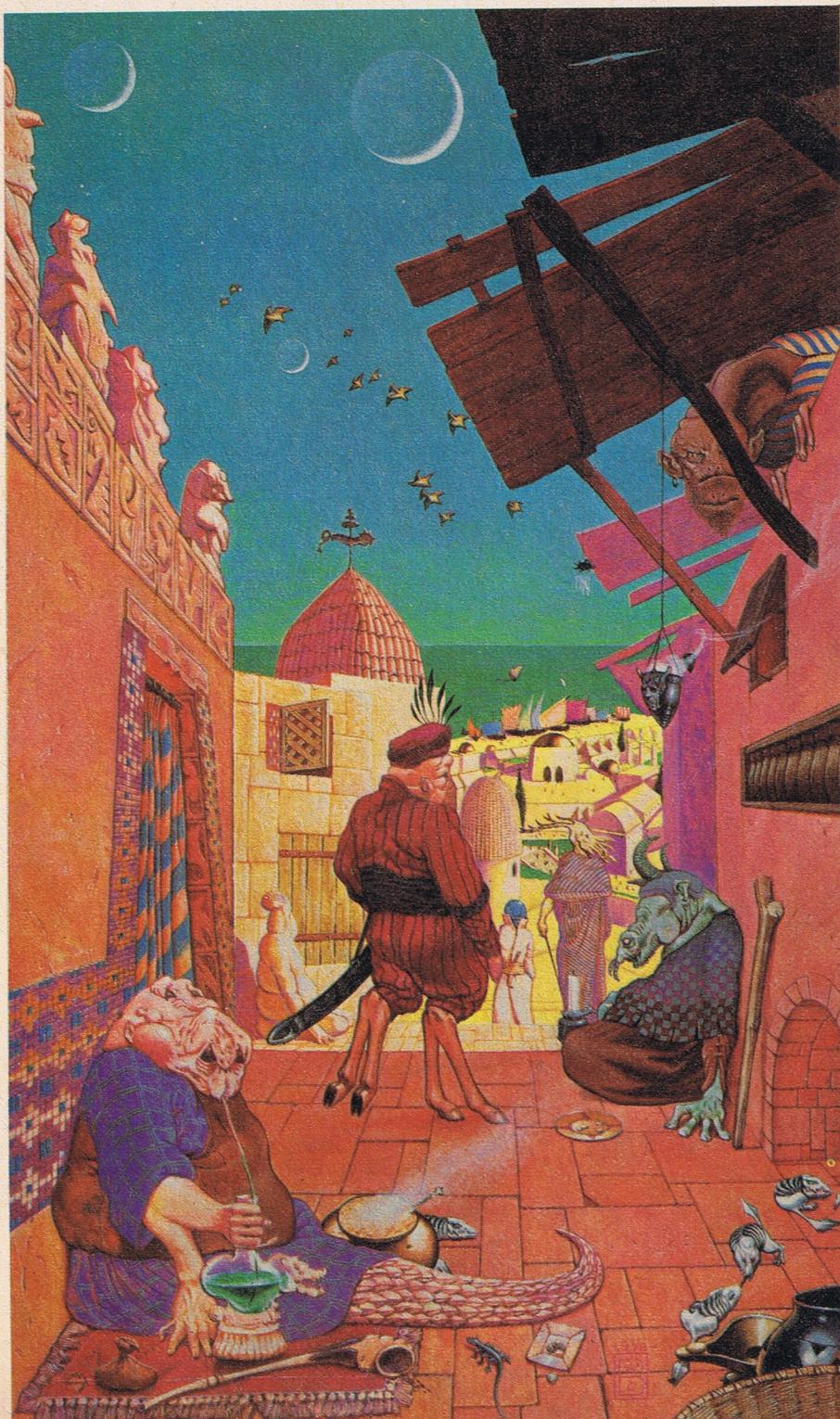
lishing mainstays like Random House, Dell and Ballantine. In fact, the work was coming in regularly enough that Wayne quit school, a decision he had no second thoughts about. "What I had gotten out of school was very good," he says, "as far as philosophy goes. I know that there is a different way of doing science fiction or fantasy art. I think it borders closer to just plain surrealism more than anything else. But there are more profound statements that you can make with the genre than most people are doing right now. Pieces that I do for myself I know would not find their way onto paperback covers."

With this ideology firmly at the core of his artistic thinking, Wayne was incubating the idea that ultimately led to the extraterrestrial guide. Its birth, however, took place in a terribly terrestrial setting. "I was sitting in a hamburger joint with my folks," he jokes. "I had been thinking to myself, after I had finished reading a couple of books, that it would be really interesting to take off on the format that my parents had been working in. Only here we would do something that would be so different. I did up a notebook page, pretty well pinning down the whole book."

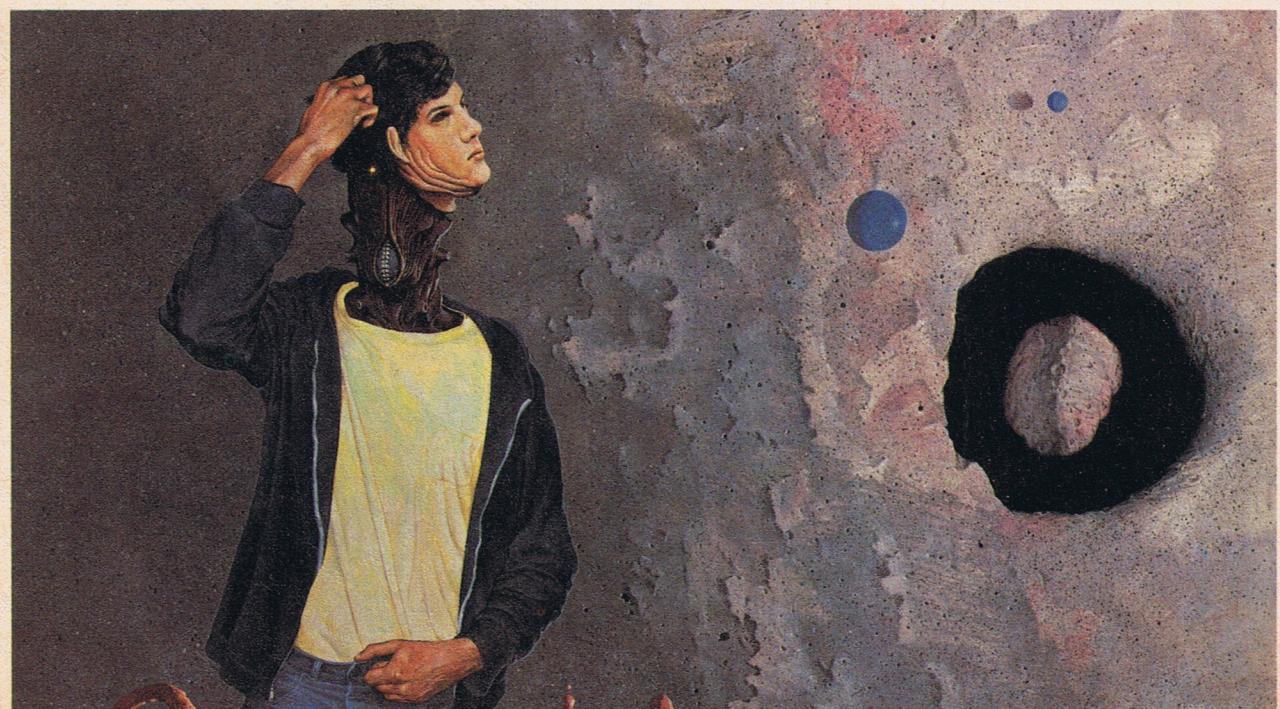
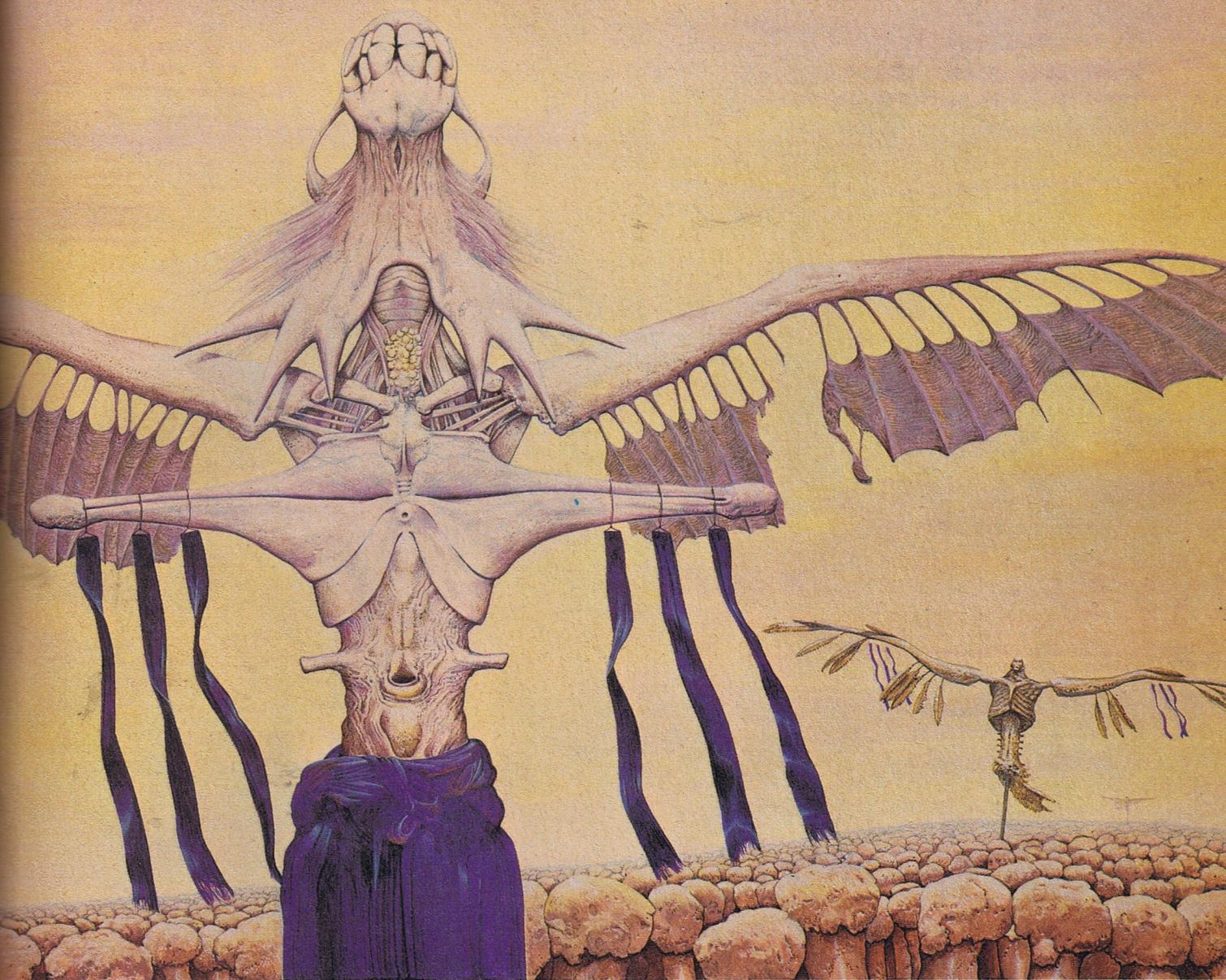
The artist continues to describe his well-thought-out plan of depicting alien life. "I always wanted to get into the organic end of it because . . . I had a great affinity for animals." Combined with his prolific love of the SF genre, "it was a natural. It just seemed like one of those ideas where you slap yourself on the forehead and say, 'Why hasn't this been done already!?'

At about the same time, Barlowe came to the attention of Ian Summers, the well-connected art director-turned-





ALL ART © 1981 WAYNE BARLOWE





"Pieces that I do for myself would not find their way onto paperback covers."

agent responsible for such science fiction fantasy projects as Workman Publishing's *Tomorrow and Beyond* and the Hildebrandt's illustrated novel *Urshurak*. In the preface to *Barlowe's Guide*, Summers recalls his first meeting with the then-18-year-old artist: "While Wayne looked young, his work had the maturity of a well-seasoned illustrator. We discussed every aspect of science fiction art that afternoon. Wayne was articulate and intelligent; he was also a reader, a rarity among artists . . . But most important, he obviously was going to be a brilliant SF artist. When we said goodbye to each other, we both knew that we would eventually work together."

Two years later, Summers' prediction came to be. Wayne had already proved himself as a paperback cover artist. Summers selected some of his original works for *Tomorrow and Beyond*. At the same time, they were already discussing Wayne's idea for the extraterrestrial guide. Its inevitable publication with Workman, in Summers' words, "establishes beyond any tomorrow that Wayne Barlowe is one of the most talented science fiction artists in the field today."

Even the most casual flip through the colorful volume attests to this fact. Complete with interesting glimpses of the artist's personal sketchbook, the A-to-V (Abyormenite-to-Velantian) guide is intelligently laid out to mimic manuals of Earthbound wildlife. Cutaways, magnifications and angular views of interesting features of each creature, combined with descriptions of its physical characteristics, habitat, reproduction and culture (if it happens to have one), result in a unique collection. And adding to Barlowe's astute appreciation for the creators of these aliens and their worlds, each is taken from—and credited to—its literary source. Included are lifeforms dreamt up by such luminaries as Hal Clement (from *Cycle of Fire*), Donald Moffit (from *The Jupiter Theft*) and Poul Anderson (from *Fire Time*).

Though as far as critical acclaim is concerned the guide was a tremendous success, in another sense it did not work out the way Barlowe had originally hoped. With the guide prominently on the book racks, Wayne figured publishers would start clamoring for him. As he later discovered, almost the opposite was the case. It seems that paperback publishers were scared off, thinking that the artist's success had priced

him out of such assignments. "I envisioned the phone ringing off the hook when people had covers that had aliens in them. The phone was dead. I had spent six months doing the book and had fallen totally out of the market. As soon as you drop out of the market, someone else fills your shoes."

"It was totally disappointing to me, because I thought that finally I had arrived at something that would make a mark for myself as a paperback artist. But then I started to realize that I have to maintain something of a double standard. Which is to do [some] pieces for myself, because they're the real way that I think, and to have a totally commercial attitude when it comes to doing paperbacks—which is really self-preservation."

Fortunately, his luck turned within a few months, and Wayne is now firmly re-entrenched in the area he likes best. "I don't believe what is going on now," he says with enthusiasm. "I'm working for about six different outfits. I have a contract for a series of anywhere from 12 to 26 James Blish books from Avon next year. It's just hand over fist right now. I can't ask for more, really."

But, of course, there always is more—if you're good enough. There's already talk of a sequel to the extraterrestrial guide. As the first was a depiction of "intelligent" life, the second would introduce us to other worlds' unintelligent beings. Wayne also reveals plans for a "major project" in collaboration with Robert Silverberg. Barlowe describes it more clearly as "a really integrated novel, not something that's just going to have pictures to offset the type."

"We're looking to make the book a throw-back to the old illustrated books," continues the artist, "where the whole book was considered as an entity, rather than today's commercial outlook. It's going to be a total odyssey." His final description comes as no surprise, considering the artist: "There's not going to be a single human in it."

* * *

The portfolio featured on these pages, though only a fraction of Wayne Barlowe's works, provides a good look at the range of the artist's talents and interests. The opening painting (p. 59), shown here for the first time, comes from Wayne's concept for a sequel to the guide. "I had this idea for these very

large, majestic creatures, which are sort of in a constant state of replenishment and decay . . . little streamers of themselves constantly trailing off."

The spread on pages 60-61 further demonstrates Barlowe's range. The faintly-winged heroine (top, p. 60) is the artist's rendering of Joan of Arc, created for a limited-edition portfolio of Barlowe's work. "It's actually my favorite piece so far. That says a lot, being that it has nothing to do with science fiction at all."

The scene of the alleyway by the sea (bottom, p. 60), taken from the Silverberg project, shows a place that is actually the floor of the universe, and the building to the left is really a sentient being. The artist describes this place as a convergent point for all creatures that inhabit the universe.

The serpentine alien (bottom center of the spread) was a quickly executed piece prepared to show reporters from *Newsday* (a Long Island newspaper), which was doing a feature on the guidebook. ("I thought to myself that it can't hurt to have an extra piece around.") "I had a Biblical idea behind this. I had done the face just as a sketch for myself, and I really wanted to use it as a painting. In the bricks—as if they had been incorporated in the manufacture—are small human skeletons. It's supposed to be very large."

Next is a self portrait (bottom, p. 61). "The painting of me taking my face off is totally improvised. I had started off with the background; I was trying to get some textures down. I felt out of place here—Earth—sort of adolescent conceit. I'm a little less cynical than I was then."

The winged, skeletal object (top, p. 61) "was meant to be a not necessarily pleasing visual thing. I was looking for a very lonely bleakness." In reality, these are scarecrows, placed in the fields by alien farmers in much the same way that Earth's farmers put dead crows on spikes out in their fields. Says Barlowe, in summing up the foreboding mood: "The idea is, if these are the scarecrows, what the heck are they scaring off?"

Finally, the marine alien (p. 62) is another creation from the guide's sequel. "The idea behind the creature is that it uses a bladder the way a blowfish does—to maintain an upright position through squid-like jet propulsion. It just pushes itself through the water."

J. ROBERT OPPENHEIMER

The Father of the Atomic Bomb

By BARBARA KRASNOFF

On January 4, 1955, Dr. J. Robert Oppenheimer was interviewed by newsman Ed R. Murrow for that newly popular entertainment medium, television. Sitting in his office at Princeton's elite institute for Advanced Studies in Princeton, New Jersey, Oppenheimer talked animatedly about the difference between applied and theoretical physics, about the effect of the atomic bomb on 20th-century humanity and about government restrictions on scientific information. He was eminently qualified to discuss all these topics—for Oppenheimer was not only one of the top physicists in the United States, but was considered by many to be the "father" of the atomic bomb. He had also, six months earlier, been declared a security risk by the Atomic Energy Commission, of which he had been one of the founders—an action which effectively prevented him from having any direct influence on U.S. nuclear policy and research.

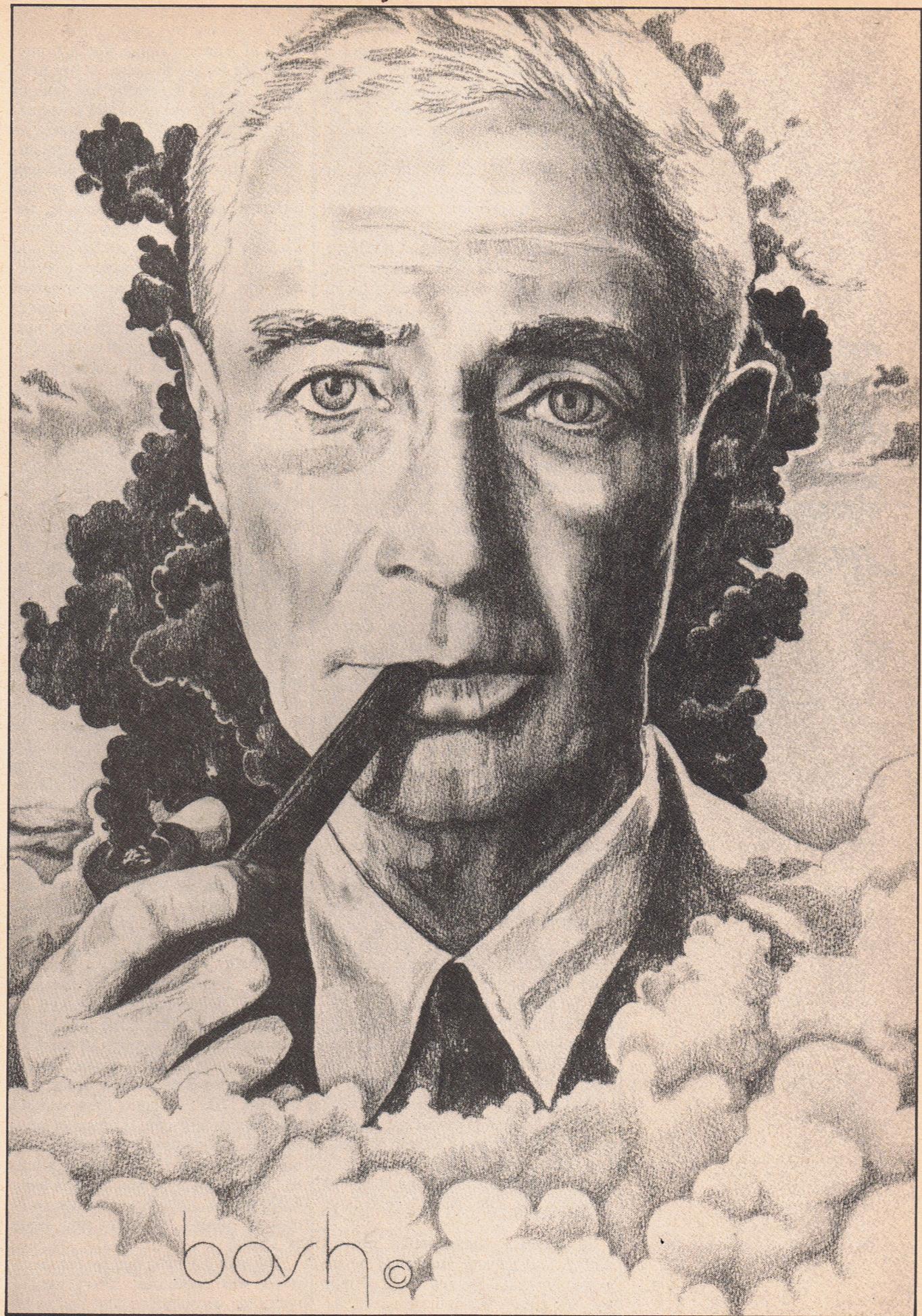
Julius Robert Oppenheimer ("Oppie" to his friends) was a man of many contradictions. Born in 1903 of a wealthy Jewish family, he gave early indications of possessing an exceptional intelligence. As a child, his interests ranged from Greek literature through mineralogy and hiking. By the time he graduated *summa cum laude* from Harvard University after three years with a degree in chemistry, it had become clear that the intense and rather arrogant young man was heading toward a brilliant scientific career. He graduated from Germany's Göttingen University with a Ph.D. in physics at the age of 23,

and after a few years of travel took up a teaching post at California's Berkeley University in 1929.

At that time physics was still a new and largely unexplored science, and the most serious students of the subject were expected to attend one of the great European universities such as Göttingen. One of Oppenheimer's dreams was to change all that; and along with colleagues such as Ernest Lawrence, who developed the first cyclotrons ("atom smashers"), he helped make the American universities of Berkeley and Caltech into centers of world physics. At the same time, Oppenheimer was becoming known for his highly stimulating lectures, and had gathered about him a coterie of physics students who, amused onlookers noted, went so far as to imitate their mentor's gestures and speaking mannerisms. And although some of his fellow physicists were put off by Oppenheimer's elitist and occasionally rude attitude, few denied his strong contribution to the scientific community.

However, while Oppenheimer's scientific reputation was growing, he was also entering a sphere of activity which would not be quite as acceptable to the U.S. government.

The 1930s were the years of the Great Depression, and in spite of such programs as Roosevelt's New Deal, poverty seemed to have taken a firm grip upon much of American society. Across the ocean, fascism was rapidly gaining ground in Germany and Italy; and when Hitler's government intervened in the Spanish Civil War, many were unpleasantly surprised when the democratic countries refused to go to the aid of the



"It was further reported that you were instrumental in persuading other outstanding scientists not to work on the hydrogen bomb project."

General K.D. Nichols
Atomic Energy Commission
December 23, 1953

beleaguered Loyalist forces. For many of America's idealistic young people, the United States government had reneged on its promises of life, liberty and the pursuit of happiness; and while most did not join the Communist Party *per se*, membership in left-wing organizations soared—associations which were to later haunt many former members in the changed political climate of the 1950s.

Robert Oppenheimer was no exception. Until the mid-1930s, he had ignored politics to the point of not being aware of the 1929 stock market crash; his entire world was comprised of his intellectual and scientific pursuits. However, the plight of the Jews in Germany, where Oppenheimer had relatives (whom he was later to help rescue), and the inability of his students to find employment appropriate to their training, shocked Oppenheimer into an intense interest in the problems around him. He began supporting the Loyalist cause in Spain and the migratory workers in California; he gave money to the then-acceptable Communist Party (although he never even considered joining) and a variety of left-wing causes; and he joined such organizations as the Western Council of the Consumer's Union and the American Committee for Democracy and Intellectual Freedom (which he later described as being largely concerned with the struggles of intellectuals in Hitler's Germany). In Oppenheimer's words, "I had no clearly formulated political views. I hated tyranny and repression and every form of dictatorial control of thought."

In the meantime, a number of events were coming together that would, six years later, culminate in an explosion that would change the world forever.

On April 22, 1939, a letter by Joliot Curie in the scientific journal *Nature* described how, through a process called atomic fission—simply, the process through which freed neutrons bombard other atoms and free more neutrons, setting up a chain reaction—a gigantic explosion of enormous power could result. The military implications of the letter were immediately recognized by both sides of the emerging world conflict.

In Germany, secret meetings were held in an attempt to encourage development of some type of atomic weapon. (Ironically, several of Europe's top physicists were meanwhile being driven to America by the Nazis' repressive policies.)

In America, a Hungarian scientist named Leo Szilard, frightened by the possibility that Germany might develop the first atomic weapon, persuaded Al-

bert Einstein to sign a letter urging President Roosevelt to support the development of America's own atomic bomb. But while Roosevelt agreed, it was to be some two years before the now-famous Manhattan Project came into existence.

By September, 1942, U.S. atomic research was proceeding along several different directions in several different locations under the direction of several different scientists. For example, the first atomic pile was being worked on in Chicago by men such as Szilard and Enrico Fermi; while Lawrence in Berkeley was trying to separate uranium atoms using a vacuum. Oppenheimer also became heavily involved in the push for the bomb, having given up his political activities in order to concentrate on the more pressing problem of beating Germany to the atomic punch.

It was about this time that newly promoted Brigadier General Leslie R. Groves was assigned by the military to be in charge of the project. Faced with the relative disorganization of the system as it stood, and with an equally disturbing security problem (on the one hand, scientists were forbidden to openly discuss their research; on the other, no progress could be made without a great deal of collaboration), he met with Oppenheimer, who had recently been awarded the position of Co-ordinator of Rapid Rupture—a rather facetious-sounding title which gave him the responsibility for designing the first atomic bomb. The two men soon agreed that the best thing to do would be to bring all those working on the project onto one central laboratory site. In this way, not only would all available energy be channeled into a single concentrated effort, but scientists could consult among themselves without increasing the possibility of leakage to enemy agents. (Enemy agents meant not only German and Japanese forces, but Soviet spies as well. The Cold War was already well under way.) The final site was Los Alamos, New Mexico.

There, Oppenheimer managed to gather together some of the most intelligent and creative scientists of the 20th century, such as Hans Bethe, Enrico Fermi, Isidor Rabi, Robert Bacher and Edward Teller. An entire town was created almost overnight, made up of laboratories, warehouses and prefabricated military housing. In these rather primitive conditions lived and worked some 6,000 people, including scientists, technicians, family members and army personnel.

The task that they had set for themselves was enormous. There were a multitude of questions that had to be

answered before the powerful weapon could even be designed. Was nuclear fission controllable enough to be contained within a single mechanism? Should they use uranium or the still-theoretical plutonium as the basis for the reaction? Could they get enough of either material to make even one usable bomb? In addition, the very nature of the resulting explosion was an unknown, leading Dr. Teller, at one point, to wonder if the detonation could possibly react with the nitrogen in Earth's atmosphere—thus effectively ending all life on the planet.

The difficulties of organizing the scientific personnel, of deciding which courses of experimentation were to be followed and which abandoned, of trying to reconcile a variety of conflicting personalities all of whom were vital to the project's success—all fell into Oppenheimer's lap. But while his own forceful character was in itself to initiate one or two minor crises, Oppenheimer's overall efficiency and skill at organizing the project was to surprise the military, his colleagues and perhaps even himself.

At 5:30 a.m. on the morning of July 16, 1945, the first atomic explosion took place at what was named Trinity Base camp, located in a desert area near Alamogordo, New Mexico. By all accounts, it was an awesome sight—a blast roughly equivalent to 20,000 tons of TNT. The scientists were jubilant—they had succeeded beyond all expectations. They had built their bomb.

Less than a month later, on August 6, the atomic bomb was dropped on the Japanese city of Hiroshima. A minimum of 78,000 people were instantly killed. Three-fifths of the city was leveled. The full effects of the resulting radiation have yet to be determined.

It is possible today, with the infinite horrors of atomic war hanging over our heads like a technological Damocles sword, to wonder how these dedicated scientists could, in all conscience, work with such fervor toward the creation of the world's most destructive weapon. It should be remembered they were working under the assumption that Germany was also doing its level best to create a similar weapon, the completion of which could have been disastrous for humanity. Even after it became clear that Germany had abandoned its quest for the bomb, many felt that the United States was the safest caretaker for such dangerous knowledge. The final word on the subject was expressed by Oppenheimer himself in a speech to his fellow Los Alamos scientists three months after Hiroshima:

"But when you come right down to it

the reason that we did this job is because it was an organic necessity. If you are a scientist you cannot stop such a thing. If you are a scientist you believe that it is good to find out how the world works; that it is good to find out what the realities are; that it is good to turn over to mankind at large the greatest possible power to control the world and to deal with it according to its lights and its values."

In the months following the explosion, Oppenheimer was widely celebrated as the "father of the A-bomb." His face appeared on the cover of *Time* and his hat on the cover of *Physics Today*. He became a top government advisor on nuclear policy, was voted chairman of the General Advisory Committee to the newly formed Atomic Energy Commission and director of the Institute for Advanced Study at Princeton. But this public eminence was soon to be tarnished by the militant anti-Communism of the 1950s.

A new type of patriotism was in the air—a climate in which the slightest taint of past Communist or "Communist-front" associations was to brand otherwise innocent men and women as possible "reds" and traitors to their country. Actors, writers, teachers, musicians—in fact, members of almost any profession—whose backgrounds or friends were labeled undesirable had their names placed on blacklists that effectively barred them from further employment in their chosen fields. Wisconsin Senator Joseph R. McCarthy assured himself of a place in the history books when he went on record claiming possession of lists of known Communists in the State Department—lists that were never actually seen. However, real panic first set in when, in the fall of 1949, the Russians gave evidence of having exploded their first atomic bomb.

The U.S. government was determined to stay ahead in the nuclear game. Edward Teller and Ernest Lawrence, two members of the Los Alamos project, became major proponents of the "super" or thermonuclear bomb—a weapon which would dwarf the Hiroshima bomb in its destructive capabilities. On the other hand, Oppenheimer was not quite as eager to promote bigger and better atomic weapons. On October 21, 1949, he wrote to Dr. James B. Conant, then president of Harvard University and member of the General Advisory Committee:

"What does worry me is that this thing appears to have caught the imagination, both of the congressional and of military people, as the answer to the

"But when you come right down to it the reason we did this job was because it was an organic necessity. If you are a scientist you cannot stop such a thing."

J. Robert Oppenheimer
Los Alamos
November 2, 1945

"Between 1939 and 1942, more probably than not, J. Robert Oppenheimer . . . either volunteered espionage information to the Soviets, or complied with a request for such information."

William Borden
in a memo to J. Edgar Hoover
November 7, 1953

problem posed by the Russian advance. It would be folly to oppose the exploration of this weapon. . . . But that we become committed to it as the way to save the country and the peace appears to me full of dangers."

In October, 1949, eight of the nine members of the GAC met in order to discuss the desirability of promoting the hydrogen bomb. Their final advice to the Atomic Energy Commission was that, "It would be wrong at the present moment to commit ourselves to an all-out effort towards its development." However, the politics of the time were against them. On January 31, 1950, President Truman announced his intention to proceed full steam ahead with the new weapon. For all intents and purposes, the nuclear arms race had begun.

Oppenheimer's opposition to that race had not gone unnoticed. In November of 1953, the Executive Director of the Joint Congressional Committee on Atomic Energy, William Liscum Borden, sent a letter to FBI director J. Edgar Hoover accusing Oppenheimer of being a Soviet agent. The memo charged, among other things, that before the war, Oppenheimer had belonged to a number of Communist organizations along with his wife and brother; that during the war

he was responsible for employing Communists at Los Alamos; and that after the war he had actively campaigned against the hydrogen bomb program. In such cases the wheels of government can move very quickly; and a letter from the Atomic Energy Commission dated December 23, 1953, was sent to Oppenheimer, detailing the charges against him and informing him that his security clearance was being dropped. He would thereafter be barred from doing any further work for the AEC and from any access to scientific information that came under the heading of "restricted data." If he chose, he could ask for a hearing to review his case.

The hearing of the Atomic Energy Commission "In the Matter of J. Robert Oppenheimer" was held from April 12 through May 6, 1954, in Washington, D.C. Three men made up the members of the Board: chairman Gordon Gray, Dr. Ward V. Evans and Thomas A. Morgan. Counsel for the Board was led by Roger Robb, known as an able and very aggressive lawyer. Counsel for Dr. Oppenheimer was headed up by Lloyd K. Garrison, a Labor Relations lawyer who was to be denied the security clearance necessary to gain access to many of the documents later used in the trial. In

Television Remembers Oppenheimer

In this, the era of the TV drama, it was perhaps inevitable that television producers should eventually turn their cameras on the life of J. Robert Oppenheimer. A new mini-series, entitled simply *Oppenheimer*, will be making its American debut on PBS's *Playhouse* sometime early in 1982.

A co-production of the BBC and Boston's WGBH, *Oppenheimer* will cover seven one-hour episodes. Each segment will touch upon an important period in the scientist's life, from his days as a physics professor at Berkeley through the development of the atomic bomb at Los Alamos and ending with the 1954 Atomic Energy Commission security hearings. According to WGBH, screenplay writer Peter Prince has not only interviewed many of Oppenheimer's former colleagues and friends, but was able, through the Freedom of Information Act, to uncover many formerly hidden aspects both of Oppenheimer's life and of the extensive security surveillance surrounding him.

Oppenheimer, starring Sam Wat-

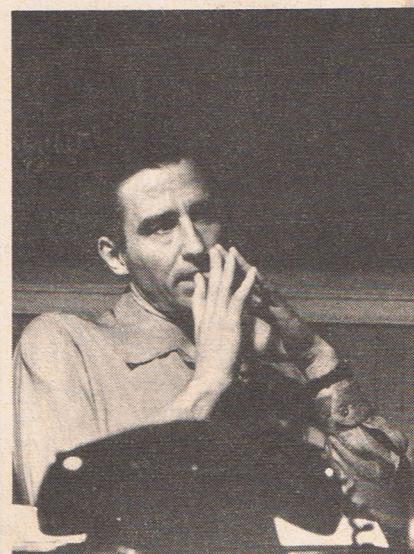


PHOTO PBS

Sam Waterston as J. Robert Oppenheimer

erston in the title role, was produced by Peter Goodchild and directed by Barry Davis. The show recently won the British Academy of Film and Television Arts Award as Best Drama series; and should, at the very least, be an interesting dramatic insight into the life of Dr. J. Robert Oppenheimer.

the meantime, the FBI was apparently keeping a close and detailed surveillance on Oppenheimer. The hearings themselves were closed to the public and the press.

The transcripts of the Oppenheimer hearings make for fascinating reading, both for the careful verbal dueling that took place between the lawyers and their witnesses, and for the insights they provide of the tenor of the times. Every part of Oppenheimer's life was brought out for examination and dissection—conversations he had held ten years earlier, parties he had attended 15 years earlier, motivations for actions taken and not taken. A parade of scientists who had worked with Oppenheimer—such as Drs. Conant, Bethe and Rabi—testified to his loyalty and dedication to the U.S., as did General Groves, the man who had been responsible for the Los Alamos project. Robb, meanwhile, followed a line of questioning which consisted of asking defense witnesses for their version of events, then producing classified documents which proved them wrong.

One oft-quoted passage from that hearing gives an excellent example of the kind of intellectual parry-and-thrust that was common throughout. At issue was Dr. Oppenheimer's 1949 letter to Dr. Conant, in which he discussed the campaign on behalf of the hydrogen bomb by "promoters" Teller and Lawrence. Robb asked Oppenheimer, "You used the word 'promoters' in an invidious sense, didn't you?" Oppenheimer answered, "I promoted lots of things in my time." Robb pursued the matter, and after Oppenheimer denied that his use of the word "promoters" in the letter was intended to be invidious, asked, "You think that their work of promotion was admirable, is that right?"

"I think they did an admirable job of promotion," replied Oppenheimer.

It could be said that, next to Dr. Oppenheimer, the man most affected by the hearings was Dr. Edward Teller. Teller, who had been in favor of the development of the hydrogen bomb for years, appeared on behalf of the prosecution. His statement that, "If it is a question of wisdom and judgment, as demonstrated by [Oppenheimer's] actions since 1945, then I would say one would be wiser not to grant clearance," was to be considered so important to the final outcome of the trial that Teller was subsequently shunned for years by many of his former colleagues.

On May 27, the Board reported its final judgment: that Dr. Oppenheimer's security clearance should not be renewed. This decision was made in spite

of the fact that, according to the report, "there is no indication of disloyalty on the part of Dr. Oppenheimer by reason of any present Communist affiliations... The conclusion of this Board is that Dr. Oppenheimer is a loyal citizen." However, they also found that his conduct and choice of associations "reflected a serious disregard for the requirements of the security system," that he exhibited a "susceptibility to influence which could have serious implications for the security interests of the country," and that his objections to the government's hydrogen bomb program were "sufficiently disturbing as to raise a doubt as to whether his future participation... would be clearly consistent with the best interests of security." The dissenting member of the Board, Dr. Evans, while agreeing with his colleagues' opinions of Oppenheimer's loyalty, stated, "I personally think that our failure to clear Dr. Oppenheimer will be a black mark on the escutcheon of our country."

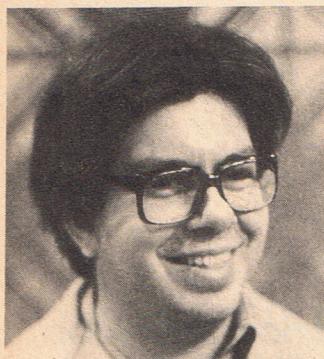
While Oppenheimer could no longer have any direct influence on the political course of atomic energy, and while there is no way to measure the emotional toll that the hearings took on him and his family, he did maintain his high standing in the academic community. In October of that year, he was re-elected to his directorship at the Institute of Advanced Studies; and nine years later, on December 2, 1963, President Johnson awarded him the prestigious Fermi Award, a presentation made annually by the AEC. About that time, some of his friends suggested that Oppenheimer call for another hearing to clear his name, but he apparently vetoed the idea.

Dr. J. Robert Oppenheimer died of throat cancer on February 18, 1967, at the age of 62. His had been a life of intense accomplishment and controversy. It can be said that, along with the contributions of a brilliant scientific career, Oppenheimer left behind two momentos of lasting and unmeasurable impact. The first, of course, is the atomic bomb. The second, more subtle but perhaps of equal importance, is the example of what can happen when a government's passion for loyalty exceeds the bounds of common sense.

Dr. Isadore Isaac Rabi, in his testimony at Oppenheimer's hearing, put it this way: "We have an A-bomb and a whole series of it, and what more do you want, mermaids? This is just a tremendous achievement. If the end of that road is this kind of hearing, which can't help but be humiliating, I thought it was a pretty bad show. I still think so." □

"I had not clearly formulated political views. I hated tyranny and repression and every form of dictatorial control of thought."

J. Robert Oppenheimer
in a letter to the AEC
March 4, 1954



Roland J. Green received his B.A. in Political Science from Ohio's Oberlin College and his M.A. at the University of Chicago. Author of the five-novel heroic-fantasy Wandor series, he is also guest reviewer for Booklist magazine and counts military history and wargaming among his hobbies.

Clyde R. Jones enjoys describing himself as a "mad scientist." He is the designer of a nuclear power plant operator training program and is currently at work completing several projects which include finishing up a book entitled *Converting Your Compact Car to Electric* working on a line of electronic toys and, he says, "looking for a good fantasy world to move into."



The Tools Of War

The best reason for studying the weapons of future conventional warfare is also the simplest. It is the most probable kind.

No one has dropped an atomic or hydrogen bomb in combat since 1945, or launched an ICBM at an enemy. Airplanes and helicopters have flown combat missions somewhere in the world every year. Tanks have done everything from deciding the fate of nations to intimidating street mobs. Even post-war developments such as hovercraft and guided "smart" bombs have gone from the laboratories to the firing line, and the infantryman has been learning many new skills without being allowed to forget his old ones.

Unless we abolish war entirely, this situation is not only likely to continue, but probably ought to. If we end up using H-bombs where tanks can do the same job, the future of war will be of interest only to extra-terrestrial archeologists who come along after the ruins of Earth are no longer dangerously radioactive.

Here are some of the educated guesses about the tools of war over the next 25 years.

Area Weapons—Large yield weapons (megaton-range and above) are already much too powerful for any conventional battlefield use, except possibly as air bursts to generate electromagnetic pulses against electronic equipment. Low-yield weapons could turn to cold fusion, in which the fusion reaction is initiated by chemical, electrical or magnetic triggers rather than by a fission explosion. This could produce a one-kiloton warhead the size of a softball

and light enough to be used in many weapons now limited to HE (high explosive) warheads.

The cold-fusion bomb will further blur the line between conventional and non-conventional battlefields already affected by the neutron bomb. Other pure radiation weapons we may see include chemically-generated electromagnetic pulses, and beamed energy weapons such as charged-particle projectors or X-ray and microwave lasers.

Chemical and Bacteriological Weapons—Like high-yield fusion bombs, lethal chemical agents are already irrationally powerful. Their future now depends on their becoming cheaper and easier to store, handle and control.

Recent experience with the delayed side effects of the defoliant Agent Orange suggests the line between lethal and non-lethal chemicals may be fuzzier than we have believed. Nonetheless, there is plenty of room for more potent descendants of today's CS (riot control) gasses, tear gas and Mace, as well as hallucinogens and other psychochemicals even more unpleasant to contemplate.

The breakthroughs in DNA research now permit the creation of new strains of disease-causing bacteria by direct genetic manipulation. This does not necessarily make large-scale bacteriological warfare more practical. Quite the contrary. In addition to the old problem of the epidemic spreading beyond the target area, we now face the problem of spontaneous mutations in the new strain, making all the carefully-planned countermeasures useless.

Non-lethal bacteriological agents are

another and much more interesting area also opened up by DNA research. Contaminating an opponent's ration dumps or the water supply of his capital city with a virulent strain of bacillary dysentery or the 24-hour flu will probably not lead to this launching the ICBM's. At the same time it will do his military efficiency no good at all.

Hyper-explosives—We can expect explosives at least ten times as powerful as present compounds. This will let us increase the effectiveness of the whole range of conventional weapons while reducing their size and weight.

Materials—Since 1900 the general trend in military equipment has been toward lightness and improved strength-to-weight ratios. This trend will accelerate, aided by such developments as carbon-fiber reinforced fiberglass (already used for items ranging from helmets to tank armor), improved plastics, semi-organic materials and possibly woven metals.

Non-ferrous metals will reduce magnetic signatures and non-metallic items will present problems to radar or metal detectors. Most present crew-served weapons may become one-man affairs. More heavy weapons will be carried on wheeled vehicles, faster, cheaper, quieter, easier to maintain and more fuel-efficient than tracked ones. Tracked vehicles themselves will increasingly be air-portable. There will be armor for such hard-to-protect targets as light aircraft, helicopters and small ships. Even the individual soldier may finally get efficient body armor, without increasing his combat load or decreasing his mobility.

Deathrays—Otherwise known as



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lasers. Lasers have been standard equipment for range-finding and target illumination since the later stages of the Vietnam War. They are also increasingly used to home in "smart" rounds, such as the Copperhead anti-tank shell. With more power generated or stored in smaller packages, lasers will become weapons in their own right. The U.S. Air Force has already mounted an experimental anti-missile laser in a C-135 jet transport.

Lasers are line-of-sight weapons, and the generator will always have to be visible to the enemy. Visible or infra-red light lasers can also be affected by weather or countermeasures such as reflecting surfaces and flares. A microwave or X-ray laser is much harder to counter, and will be effective at least against electronic equipment. More powerful lasers will also do their damage in a time too short to permit the enemy to react.

Small Arms—A small arm is any weapon which can be carried and fired by one man. This category now includes rifles, pistols, submachine guns, flare projectors, grenades, and light anti-tank and anti-aircraft rockets. Improved materials and hyper-explosives will increase this range. So will improved ammunition.

The caseless round is a normal bullet with a shaped and hardened piece of explosive at the base instead of a metal cartridge. Eliminating the cartridge makes the whole round smaller, lighter and cheaper, so that a soldier can carry more rounds and increase his firepower without increasing his load.

Rockets fired from hand weapons, descendants of the Gyrojet round, are another possibility. Today these lack striking power at short range and accuracy at long range. Better propellants could increase the rate of acceleration and solve these problems.

Still in the science fiction category for small arms is the projectile fired by a series of electromagnetic pulses. However, the same developments in power generation and storage which may give us the combat laser could also give us the electro-magnetic rifle. Smooth acceleration would reduce recoil and permit firing much heavier projectiles from a shoulder weapon. We may see not only solid and explosive bullets, but miniaturized electronic packages, gas canisters, flares, small rockets and anti-tank grenades.

The future infantryman can also expect the improved sights needed to use the increased range and striking power of his personal weapon. We are not far off from the "smart" rifle, with a built-in telescopic night sight, laser rangefinder and wind-drift calculator.

Electronic warfare—Electronic warfare used to mean jamming the other side's radio and radar and trying to keep your own clear. In future wars, the computer will be even more vital than radio and radar were in World War II.

Even today, computers are found in hundreds of applications on land, sea and in the air. They navigate and monitor the on-board systems of planes and ships, guide shells, smart bombs and missiles, scramble and encode communications, troubleshoot malfunctioning equipment and keep payrolls.

As the microchip revolution continues, the smart rifle will be only the start. We may see the smart small-arms round, computerized scramblers and coders in the helmet radios of individual soldiers, and a portable computer replacing company headquarters. There will also be at least the first generation of robot soldiers. These will be essentially computerized booby-traps, linked to sensor systems in front and manned headquarters in the rear, saving a great deal of manpower now tied up on security duties.



As the armed forces' use of computers increases, so will their vulnerability to attacks on those computers. The outcome of the next war may be determined by who has the best computer virus—a short data statement or microprogram injected into a computer to fill up its available memory and block its operations. Designing computer viruses is already a popular game in American colleges; the children of those college students may be doing the same thing for much higher stakes.

In general, the effective defense of military computers requires high-grade programming, small, highly mobile computers, and as much decentralization as the available communications technology and hardware permits. This clashes with the normal military emphasis on hierarchy and centralization, but unfortunately this is a battle the generals are going to have to lose if computers are to be used effectively in future wars.

The Yom Kippur War of 1973 demonstrates the necessary direction in which the electronic battlefield must move. The Egyptian air defense system was based on fixed installations, including the radar and missile-control computers. It began to lose its effectiveness as soon as the Egyptian army moved beyond the slant range of the missiles. It fell apart completely when the Israelis crossed the Suez Canal and began physically demolishing the radar stations and computers.

Land, Sea, and Air Vehicles—Because of the firepower of modern weapons both defensively and offensively, every commander at every level has to follow the Napoleonic maxim: "Move divided, fight concentrated." This requires mobility, which is fortunately improving.

Land vehicles will be lighter, faster and more heavily protected, with more powerful, lighter and more economical power plants. All-wheel drive vehicles will replace tracked ones for many uses.

High-performance manned aircraft are already approaching their limits in speed, altitude and maneuverability. We should see them more durable and easier to maintain, if not necessarily cheaper.

More radical changes in air warfare are likely to come from unmanned aircraft, the descendants of the reconnaissance drones the Israelis have been using over Lebanon. Without a human pilot,

an airplane's weight and size can be reduced, and it can maneuver without regard for the "g" tolerance of the human body. Drone bomb and missile carriers should be taking over many attack missions within another decade, although drone air superiority fighters may take a while longer.

Missions at lower speeds and altitudes may see STOL (short takeoff and landing) or VTOL (vertical takeoff and landing) aircraft take over from helicopters, which require an enormous amount of maintenance for each hour in the air. Hovercraft and ducted-fan vehicles may also handle many of the "low and slow" missions, particularly those over water. Lightweight armor can protect them better than it can protect the fragile rotor system of a helicopter.

With hyper-explosives, the individual soldier may finally be able to fly with a controllable rocket belt. At the very least, such rockets may replace parachutes for air-dropped cargo and vehicles.

That classic SF concept, powered combat armor, may even become possible. Whether it will ever be practical is another matter, since it could end up greatly increasing the infantryman's value as a target without proportionately decreasing his vulnerability to the enemy's weapons. More specialized exoskeletons, however, should have a bright future for combat-engineer and supply-handling work.

The anti-ship missile has given small ships a fighting chance against big ones, in the same way the anti-tank missile gave the infantryman a chance against tanks. Like the tank, the large warship is not necessarily going to disappear—it is the best way of carrying certain kinds of weapons and sensors. Like the tank, it is going to have to make certain adjustments, such as a revival of armor and less vulnerable sensors and launchers.

In general, all ships will shrink in proportion to their firepower, thanks to improved materials, electronics and power plants. Semi-automated ships will reduce the demand for trained manpower, and VTOL/STOL aircraft may eliminate the large aircraft carrier. Under the sea, some form of electrical propulsion such as fuel cells may revive the conventional submarine, and "smart" mines sophisticated enough to be virtually robot submarines may take over much of the work of attacking ship-



ping. Finally, merchant ships in any future war may be able to carry some of their own protection with them, in the form of pre-packaged guns, missiles, homing torpedoes, electronics and sensor systems.

Thanks to all these developments, the decision-makers face a whole new range of choices, both in preparing for war and in fighting it.

1. Level of violence—As weapons improve, any military unit will be able to function at many different levels of violence. An infantry brigade will be able to suppress a riot or raze a whole city to the ground. A patrol boat will be able to stop a cocaine-smuggling yacht or sink a super-tanker 30 miles away. Helicopters will be able to destroy a single tank with an HE missile or a whole battalion of them with a cold-fusion warhead. With the level of violence no longer dependent entirely on the nature and size of the units on the spot, the decision-makers' already complex job of deciding how much to use will become still worse.

2. High-performance platforms vs. high-performance weapons—We can now build high-performance vehicles such as the F-15: sophisticated, specialized and extremely expensive. We can also build vehicles with a lower performance, but carrying powerful weapons. The missile-armed patrol boat, the jeep carrying a tank-killing missile, or the slow A-10 attack jet with its 30-mm

Gatling gun and smart bombs are existing examples of performance built into the weapon rather than into the weapons platform.

The high performance weapon isn't always the optimum solution, and certainly not a simple one. It requires much thought and planning for adequate training, maintenance and reliability. It is still likely to be the preferable solution in an increasing number of cases. It already costs more to build performance into the platform than into the weapon, and the gap will increase. A sufficiently versatile weapon (such as the American harpoon missile) can be launched from a wide range of platforms. Finally, counter-measures effective against the weapon are likely to be nearly as effective if not more so against the far less expendable and often manned platform. Even if a given target absorbs eight missiles, it's still cheaper than expending two planes and three crewmen.

The mass army vs. the elite force—Some conventional notions of war imply a dichotomy between large masses of moderately-trained men with simple weapons and handfuls of super-troopers with immense firepower. This dichotomy began to erode with the development of automatic weapons. In the coming era of durable materials, hyper-explosives and solid state electronics, all sorts of pre-packaged, low-maintenance and nearly foolproof weapons will put an even greater power into the hands of the least trained and educated soldier.

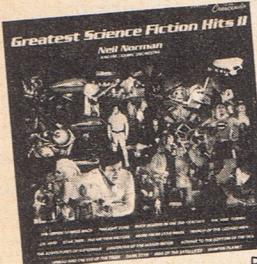
Semi-literate Egyptians have already destroyed crack Israeli tank battalions with pre-packaged Russian missiles. The Chinese are buying large numbers of more advanced missiles in Europe, preparing for a confrontation with the U.S.S.R. Afghan and Somali guerrillas have been eagerly trying to get hold of heat-seeking portable anti-aircraft missiles just as their fathers sought modern rifles.

As long as there are few effective restrictions on the spread between weapons or the technology to manufacture them, the gap between the educated and uneducated fighting man will continue to narrow. In a world where most of the educated soldiers tend to come from rich countries and most of the uneducated ones come from poorer countries, this narrowing gap could be more dangerous than the atomic bomb or nerve gas. □

Neil Norman and his
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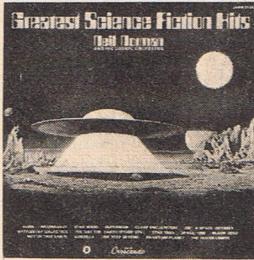
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BIRTH CONTROL

One of the most important freedoms that women today have attained is the freedom from unexpected and/or unwanted pregnancies—more popularly known as birth control. For the businesswoman, it means the ability to retain a secure place in her profession; for the mother, it means the ability to choose how many children she can properly care for. However, over the last 40 years, there has been little change in available birth control methods—until now. In FUTURE LIFE #32, we will take a close look at the still controversial issue of birth control—the drawbacks of today's methods, and the possibilities of tomorrow's.



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PLUS

Harlan Ellison continues his attack on "knife-kill movies," and unveils his campaign to keep them out of the theaters Dave Fleischer tells the story of Jim Blinn, one of the new breed of computer artists, whose electronic images are used by NASA to animate space and our usual mind-boggling collection of fascinating facts from Soundscapes, Earth Control, Gallery, Portfolio, book reviews and Databank news.

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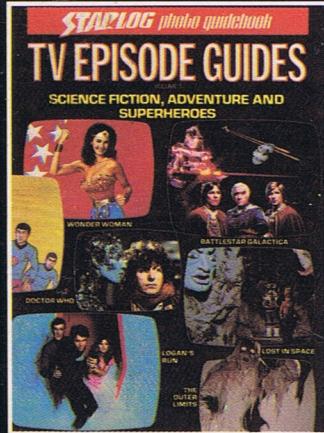
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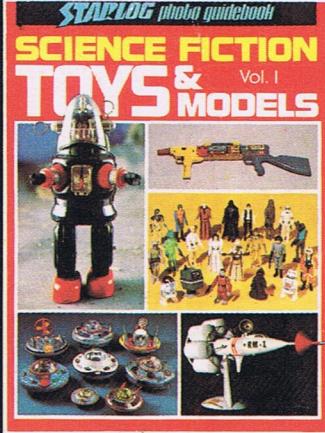
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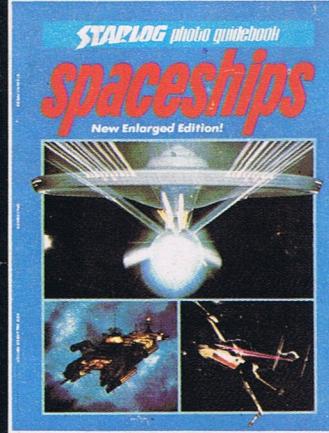
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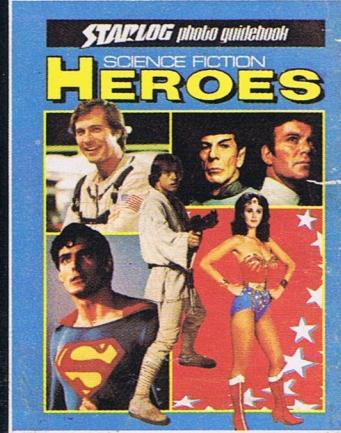
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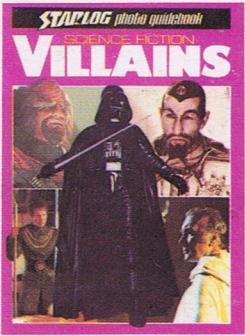
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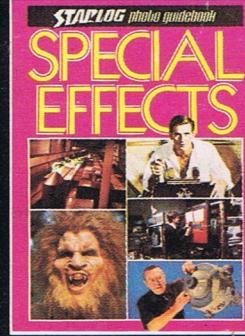
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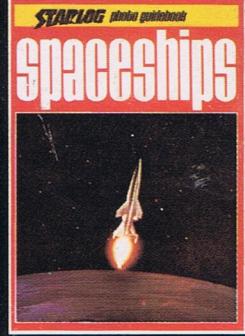
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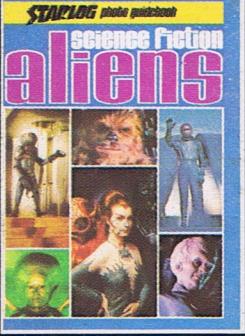
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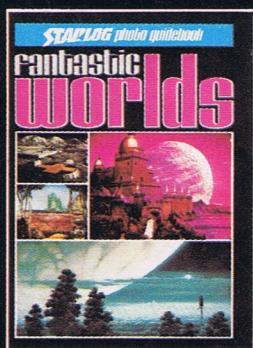
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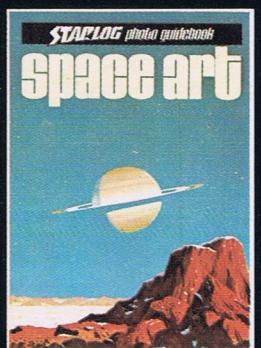
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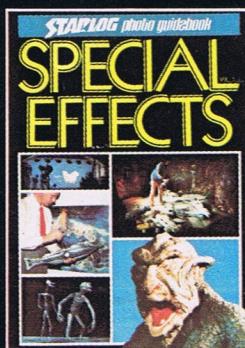
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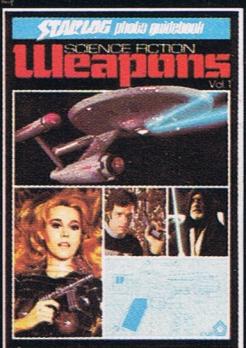
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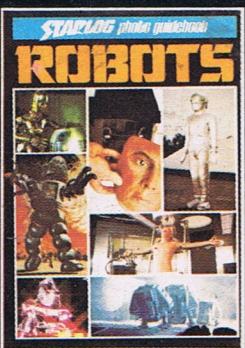
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